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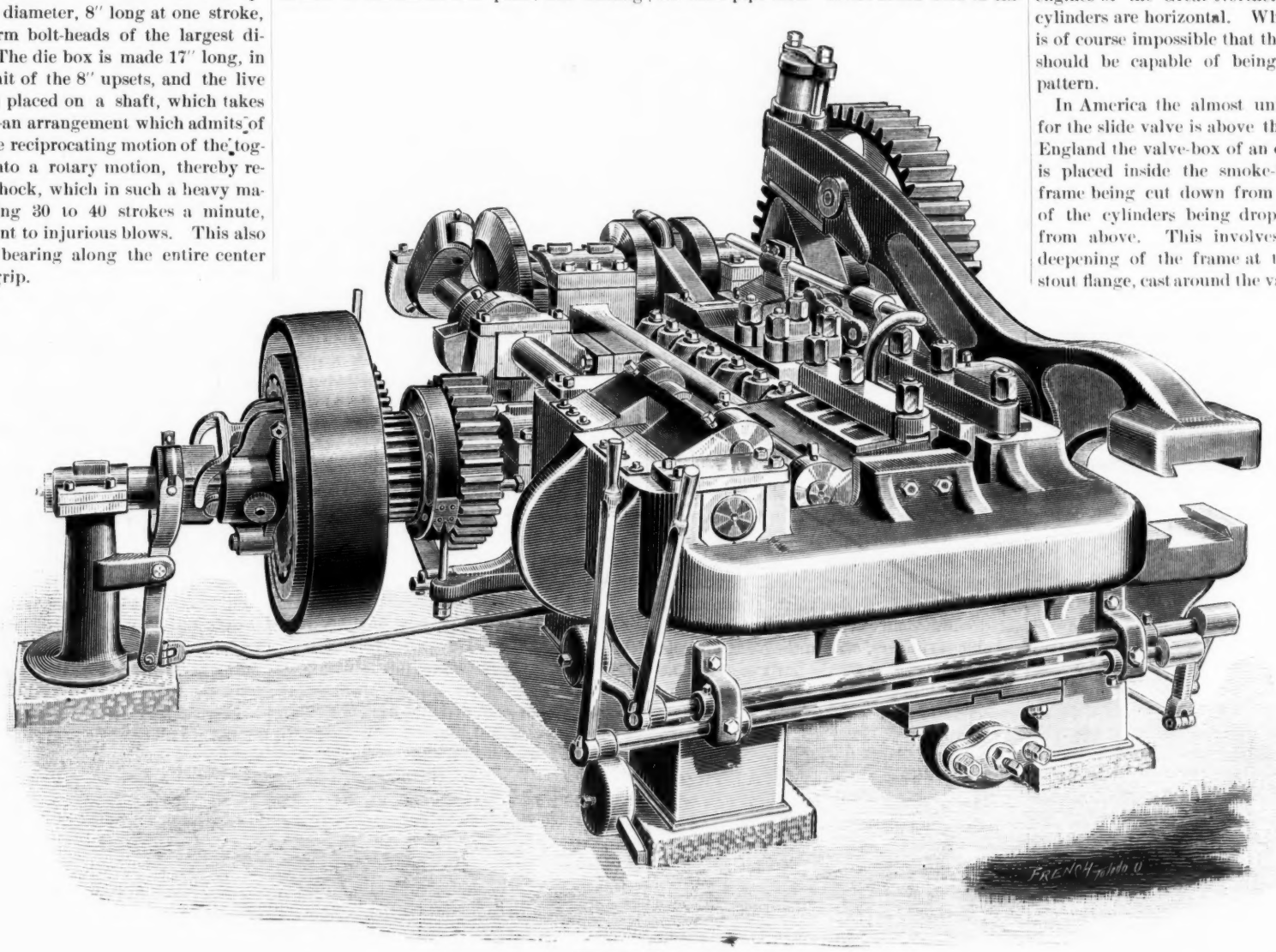
A Powerful Forging Machine.

The accompanying engraving is of a new machine for heavy forging operations, recently brought out by the National Machinery Co., of Tiffin, Ohio, a company which makes a specialty of bolt and nut machinery. The machine is arranged to work either singly or double geared, according to the requirements of the work, and is made powerful and strong enough to do the heaviest forging required of machines of its class. It will upset 3½″ to 4″ diameter, 8″ long at one stroke, and will form bolt-heads of the largest dimensions. The die box is made 17″ long, in order to admit of the 8″ upsets, and the live die has been placed on a shaft, which takes the weight—an arrangement which admits of changing the reciprocating motion of the toggle joints into a rotary motion, thereby reducing the shock, which in such a heavy machine, making 30 to 40 strokes a minute, would amount to injurious blows. This also admits of a bearing along the entire center line of the grip.



FORGING MACHINE.

The shear lever is converted into a trip hammer, giving three blows for every revolution of the main shaft. Dies for swaging can be placed in this, and work prepared for the upsetter or heading tool. A new feature of the machine is the irregular face cam motion for closing the dies, the arrangement of which is shown by the cut.

The machine has a powerful friction clutch, with automatic release of same, and by means of the levers shown the operator has complete control of the motions, can start or stop it at any time, or, by setting a lever, the machine will automatically stop at the end of each stroke.

A State weather bureau is to be organized at Cornell University. It is to be hoped that its predictions will be an improvement on those of the signal service, which are usually, but not with unerring certainty, interpreted by the rule of contraries.

English and American Locomotive Practice.

BY W. H. BOOTH.

SIXTH PAPER.

In the connection of the barrel of the boiler to the smoke-box, there is a wide difference in practice. In the usual American practice the first ring of the barrel is directly attached to the smoke-box plate, and butting with the smoke-box liner. The front tube plate is a simple flanged disk fitting inside the barrel.

In English practice the front ring of the barrel is attached to an angle iron, and this in turn is riveted to the front tube plate, which is attached to the plate of the smoke-box. To renew the tube plate is an expensive job, and involves much work and dismantling.

In the American plan, so long as all rivet-heads in front of the tube plate are countersunk, the plate should be readily removable, except for the obstruction offered by the door ring, which needs removal before the tube plate can pass. In any case, despite the sacrifice of this case of renewal, the American plan appears best, for the downward projection of the lower part of the English tube plate for attachment of the boiler, could readily be changed for a slightly modified arrangement.

The brick arch in the fire-box, which is looked upon in England as so favorable to economy in fuel, is anything but general in American practice, and might with advantage be more employed.

Spark arresters, when employed in England, are usually cones or grids, of wire netting, arranged to extend from the blast nozzle to cover the base of the chimney if of the cone variety, and if plain grids, to extend horizontally over the whole of the smoke-box area, just above the top row of tubes, but leaving the blast pipe free. If not much used in England, it is not because English engines do not throw sparks, for they do this very freely, but because of the general moisture of the vegetation, which checks any extensive spreading of a fire. The large side breadths of land between the fence and the track usually prevents damage to crops.

There is a good deal of difference between the cylinders and their connection and parts, in the practice of the two countries. In an American engine each cylinder is a counterpart of the other, and is cast from the same pattern, no right and left being needed, for they are attached horizontally in their places, and the recesses for taking the bar or bars of the framing are simple parallel grooves in the casting, so that a cylinder, being alike back and front, is equally adapted for either side of the engine. In English practice it is quite common to give the cylinders some inclination, the front end being higher than the back. This is done for various reasons. In freight engines with inside cylinders it raises the crosshead slides, etc., above the leading axle, the main rod always taking hold of the central axle.

In the inside cylinder passenger engine the cylinders are usually horizontal; in the outside cylinder engine they are sometimes slightly inclined, the reason for this being partly appearance and partly to allow of a leading wheel of larger diameter being employed. In the large eight-foot single driver engines of the Great Northern Railway, the cylinders are horizontal. Where inclined, it is of course impossible that the two cylinders should be capable of being cast from one pattern.

In America the almost universal position for the slide valve is above the cylinder. In England the valve-box of an outside cylinder is placed inside the smoke-box, the plate frame being cut down from above, to allow of the cylinders being dropped into place from above. This involves, of course, a deepening of the frame at this point, and a stout flange, cast around the valve chest body, serves as a means of attachment of the cylinder to the framing. The position is one of advantage economically, and in this respect is far superior to the exposed position of the valve-box of the American engine, which, despite its covering, must lose heat enormously in its rapid passage through the air, and cause great loss of power and of fuel.

As already stated, in the case of inside cylinders the usual English practice has been to place the valves between the cylinders. Such a position is most awkward, for the distance between the frames is really only sufficient for the cylinders themselves, not to mention two valves. These, however, are crowded in, the two valve chests being cast together. In fact, in an inside cylinder engine the two cylinders, with their valve chests, form a single casting, and it is far from a pleasant piece of work re-facing the valve faces of this class of locomotive. Necessarily, special machinery is required to plane them

up in position. With cylinders of larger size the valves are placed below the cylinders, in which position there is obtained the incidental advantage that the valves drop just clear of their seats when running without steam. It is claimed as an advantage possessed by the Joy radial gear over the link motion gear, that the Joy gear is suited for inside cylinder engines with the valves above the cylinders, and therefore in the warm smoke-box. In the American engine the link motion is suited to the same position of valve by suspending the link block from an arm projecting downwards from a rock shaft, whilst another arm projecting upwards from the same shaft takes hold of and actuates the valve spindle. The results of this plan fully justify the means employed, for the working is most satisfactory.

In English valve gears of the link motion type—still by far the most common—the link block is carried upon the extremity of a guide bar, connected with the valve spindle, which guide bar works in a socket guide attached to a transverse piece between the frames. The link block thus has a rectilinear motion.

So far as regards eccentric rods and other parts of the valve gear, main rods, coupling rods and pins, there is really but little diversity in practice, further than what is marked by the use of built-up links in America, in place of the solid-slotted English link, and the tendency towards larger pins in American practice.

Possibly also the use of single crosshead guide bars is peculiarly or more frequently American than English.

Design, Construction, Repairs and Management of Marine Steam Engines and Boilers.

By W. H. Hoffman.

FOURTEENTH PAPER.

As our crankshaft will be sectional, we shall have plenty of space between cylinders for the arrangement of valve chests, covers, etc. Our valves will be of the piston type for all cylinders, there being one for the 26″ high pressure cylinder, one for the 40″ intermediate cylinder, and two for the 68″ low pressure cylinder, both of the latter being actuated from a central connecting point. The centers of the high and intermediate valve stems will be on a line fore and aft, and the center line between the two piston valves of the low pressure cylinder will be on the same fore and aft line. The valve motion proper will be a modification, and in a slight measure a combination of the best movements of the Hackworth, Marshall and Kirk valve gears, but not a modification or combination that increases the number of [illegible] of the well-known motions. Only one eccentric is used for each cylinder, and that is conveniently located for examination at all times. There will be some new points in the arrangement of the details of this modified valve gear, which will be fully explained in another paper.

In using the valve motion described, our steam chests will be a little to one side of the center of the engine, as the eccentric rod lever will be pivoted near, but to one side of the center of the shaft, the pivoting point swinging by direct connection to the quadrant block.

Placing the steam chests away from the center line of the engine gives us an arrangement of lower chest covers and stuffing boxes that cannot be excelled as to convenience. Each chest will be so located that it will occupy the curved corner spaces occurring between the cylinders, thus presenting very little projection from the main bodies of the cylinders and receiver casings.

On the main bed plate and frames there will be cast special seatings for carrying the quadrants, and their attachments necessary for reversing.

The eccentrics will all be of the same size and throw, and the lever eccentric rods will be the same on each motion for each cylinder. The rods reaching from the eccentric levers will have adjustable boxes at each end, also a distance adjustment for keeping these connections always the same length. Vibrating and oscillating pins and boxes wear rapidly, and require a great deal of adjustment in order to compensate for this wear, but with an independent method of lengthening and shortening, the accuracy of the valve motion can always be maintained.

The valve stems will be guided at a suitable distance by plunger guides, working in cylinders completely encased in oil, so that continuous lubrication is assured at one of the most vital points on a marine engine.

All marine engineers know that the valve stem guides of our large marine engines are frequently quite troublesome as to the matter of lubrication, and the writer has personal knowledge of one instance at least, where a new coastwise ship, well loaded with passengers and freight, was in great peril for hours off the coast of South Carolina, owing to a lack of lubrication on one of the valve stem guides. In this particular case, the oil holes leading to the valve guide surfaces were small and long; the oil "gummed" in the holes, and thus reduced the supply to such an extent that the valve guide block "hung fast" in the guide. Of course there could be but one result, and that came quickly, for the heavy eccentric rods and pins were strong enough to pull the valve guide (weighing about one thousand pounds) from the cylinder, besides bending a 4″ valve stem to an angle of about 30° and twisting all of the link connections. The accident occurred about midnight, with a strong "norther" well on, and the ship was "hove to" for fourteen hours, in order to make the necessary repairs.

The valve stem guide block will not wipe the oil over the surface of the guide, because the stroke is too short for effective self-lubrication; the main crosshead of an engine, however, sweeps the oil quite effectively, because it has a long stroke. Usually, the oil on the valve stem guides will run off about as fast as it can be applied either automatically or by hand.

The valve guide plungers in our system will be fed from a static oil column, and the oil will be returned automatically to this column by the action of the plungers. Thus we have a constant oil feed for the lower end of our valve stems, and at the same time these plungers are a part of the distance adjustment for raising and lowering the valve stems. The packing for these plungers is simple angular leather cups, pressed in a former before they are placed in position. The upper end of the valve stems will be fitted with small steam pistons, working in suitable cylinders, cast in the chest bonnets, these pistons being for the purpose of balancing the weight of the valves and all the parts attached to them.

The upper and lower sections of each valve will be cast separately and keyed or clamped together at the center, so that either section can be removed from the steam chest without disturbing the other, the design of the stems permitting the lower section to be dropped after removing the lower steam chest cover, which will be made in halves for convenience.

Of course the valve plunger guides will be set low enough to allow the lower sections of the valves to drop clear of the steam chest bonnet bolts, so that a thorough examination can be made and repairs carried on if necessary. It will be readily seen that the space around these lower chest bonnets will be entirely free from obstructions, so that any of the details of the upper portion of the valve gear and the lower portion of the valves can be instantly reached and disconnected in case of accident.

The main *working* portion of the valve motion is far below this point, and does not obstruct in the slightest degree the space near the standing platform for working the engines.

The reeds and rushes of the lowlands of the Parana are destined to become of incalculable value for paper pulp, and as a fiber for textile fabrics. The invention of Mr. Newman, by which wool and silk are made from reeds, ranks not a jot below that of electrical development. We have examined heavy goods for overcoats, blankets, and gentlemen's wear, feltings and black silk dress goods, all made out of the fiber of these rushes, which, for texture, for finish, for strength and for holding colors, we could not distinguish from similar goods made from wool and silk.—*Buenos Ayres Herald.*

Shop Notes.

At Germantown Junction (Philadelphia), where the Pennsylvania, and Philadelphia & Reading railroads cross, have recently been built the shops of the Barr Pumping Engine Co., which are devoted exclusively to, and fitted up with special reference to the production of, steam pumps and pumping engines.

Mr. William M. Barr, the well-known mechanical engineer, and author of several standard works on engineering subjects, is one of the proprietors, and is in charge of the shops and of the engineering department of the business, the shops having been designed and built under his supervision, and the special machinery, which constitutes a large proportion of the equipment, having been designed by him, and built to his order.

The shop is a substantial brick structure, three stories in height, well lighted, and provided with modern improvements, steam heat, automatic fire sprinklers, etc. Along the railroad are sand and coal bins of brick, with receiving doors car-floor high.

The foundry is a model one, and is provided with the latest approved devices for such work, among the notable features being a complete outfit of iron flasks, having the joints planed to secure accurate fits. The flasks for cylinders are bored out at the ends to receive the core prints of the pattern, and finally the cores, thus securing the accurate placing of the cores, the exact distance between centers, and, consequently, a uniform thickness of metal all around the cylinders.

The upper story of the main building is at present used mainly for pattern making, the second for the lighter manufacturing and the offices, while on the ground floor are the heavier tools, where the larger work is done.

The aim is to apply to the manufacture of pumps the principle of the duplication of parts by gauges, special tools and fixtures, in the same manner as other and lighter lines of work are produced, modified, of course, to meet the requirements caused by the different character of the work.

With a view to facilitating this feature of the work, and for the securing of other well-understood advantages as well, a definite system has been employed in the designing of each line of trade pumps, so that any one starting at one end, and knowing the "law of the series," might predicate the other end. The steam and water ends are treated as separate units which combine to make a pump, and, within certain limits, any steam end may be taken from finished stock and connected to any water end, thus producing at will a low pressure pump for circulation, or tank supply, or a high pressure pump for working against a greater head, boiler, or other pressure. Furthermore, since varying conditions of the fluids to be pumped require distinct and well-known variations in the reciprocating parts of the water end, while the chambers and valves may remain the same, advantage has been taken of this fact to produce from the same patterns, water ends fitted with piston, plunger and ring, or outside and inside packed plungers, as the circumstances may require.

Jigs and templates are made use of for drilling all holes, so that cylinder heads, steam chests, steam chest covers, stuffing-box glands and other parts are interchangeable, and may be selected at random and used for any pump of the same class.

For instance, after the hole for the piston-rod and stuffing-box gland has been bored (which is done to standard gauges), there is a jig provided with a steel plug, which fits into this hole. In this jig, the holes for the cylinder-head bolts, and also those for receiving the ends of the round bars which connect the water and steam ends of the pump, are drilled.

The cylinders of the smaller duplex pumps are bored upon a machine of Mr. Barr's design, which is worthy of note. The machine is so arranged that the head may be readily taken off and another one substituted. There are three different heads, each having two parallel spindles, which are at just the right distance apart for a certain pump. The same driving and feed gear answers for any head, and the boring bars pass from the spindles over a horizontal platen, to which the cylinders to be bored are fastened; the outer end of the bars being supported by bushings, which are in a fixture, one of which goes with each head. Thus, by this machine, the two cylinders of either end of a duplex pump are not only bored at the same time, but are made parallel with each other, and at a distance from center to center which is fixed and invariable. The intention is, when the growth of the business demands it, to make two more beds, with driving and feed mechanisms, and thus have three complete machines, each adapted to pumps having a certain distance between centers of cylinders; but in the meantime it is the work of but a few moments to change the heads. The larger cylinders are bored upon a machine, also of Mr. Barr's design, which is very heavy and massive, and has a fixed head block and a movable foot block. Between these is the platen, to which the cylinder is secured. A sliding boring bar passes through both the head and foot blocks, and in each block works through a sleeve which is provided at the end nearest the cylinder with an arm, carrying a small tool rest, sliding upon suitable ways, and fed by a star feed. Thus, while the cylinder is being bored by the bar, both of the flanges are faced off. The platen of this machine is movable along the bed and laterally also, but has no vertical movement, fixtures being provided by which the cylinder to be bored is brought to the height of the bar. The form of boring heads adopted to use with the bars consists of a heavy cast-iron disk, approximating the size of the cylinder to be bored, and provided with a number of holes drilled into its edge radially, which receive cutters made of round steel, held in place by set screws. These cutters bore out the cylinder nearly to size, after which they are removed from the head, and other cutters inserted in dovetailed slots made for the purpose, in the same head. These cutters are made in the form of reamer teeth, but are shorter, and are secured in place by wedges. They are ground to standard size and backed off in their places, so that, by removing the boring cutters and substituting these, the head is converted into a reamer, which, upon being run through, reams the cylinder accurately to standard size.

There is also a horizontal boring machine of the usual type, having an elevating table resting upon two screws, which are actuated by power through the medium of worms and wheels at the bottom of the screws. Some of the proportions of this machine have been modified somewhat, to adapt it to the special work to be done. Other modifications of well-known machine tools are to be seen, in addition to which there is a number of regula tools.

No planing is done upon the regular lines of pumps, milling machines (mostly of special construction), being used instead. One of these has two heads, between which the platen travels, so that work passing once through is milled on two sides, even though the work is of such a character as not to admit of straddle milling. It is evident from an inspection of the works that much care has been exercised in their arrangement and equipment, and that the course pursued has been dictated by good judgment and wide experience in manufacturing operations.

The small size of the engine which has been put in to drive the works is apt to attract attention. It was built by the Stearns Manufacturing Co., of Erie, Pa., and works well, but seems to the casual observer to be rather small for such a shop, especially one which is expected to grow. Mr. Barr said, in relation to it, that the engine was ample for the present work and for some additional, and that a demand for more power than it could economically furnish would be met by the

purchase of an additional engine, and not by the substitution of a larger engine for the present one; his belief being that it is better practice to provide two or more smaller engines (supplied with steam from the same boilers, however), rather than one large engine, for an establishment of that kind.

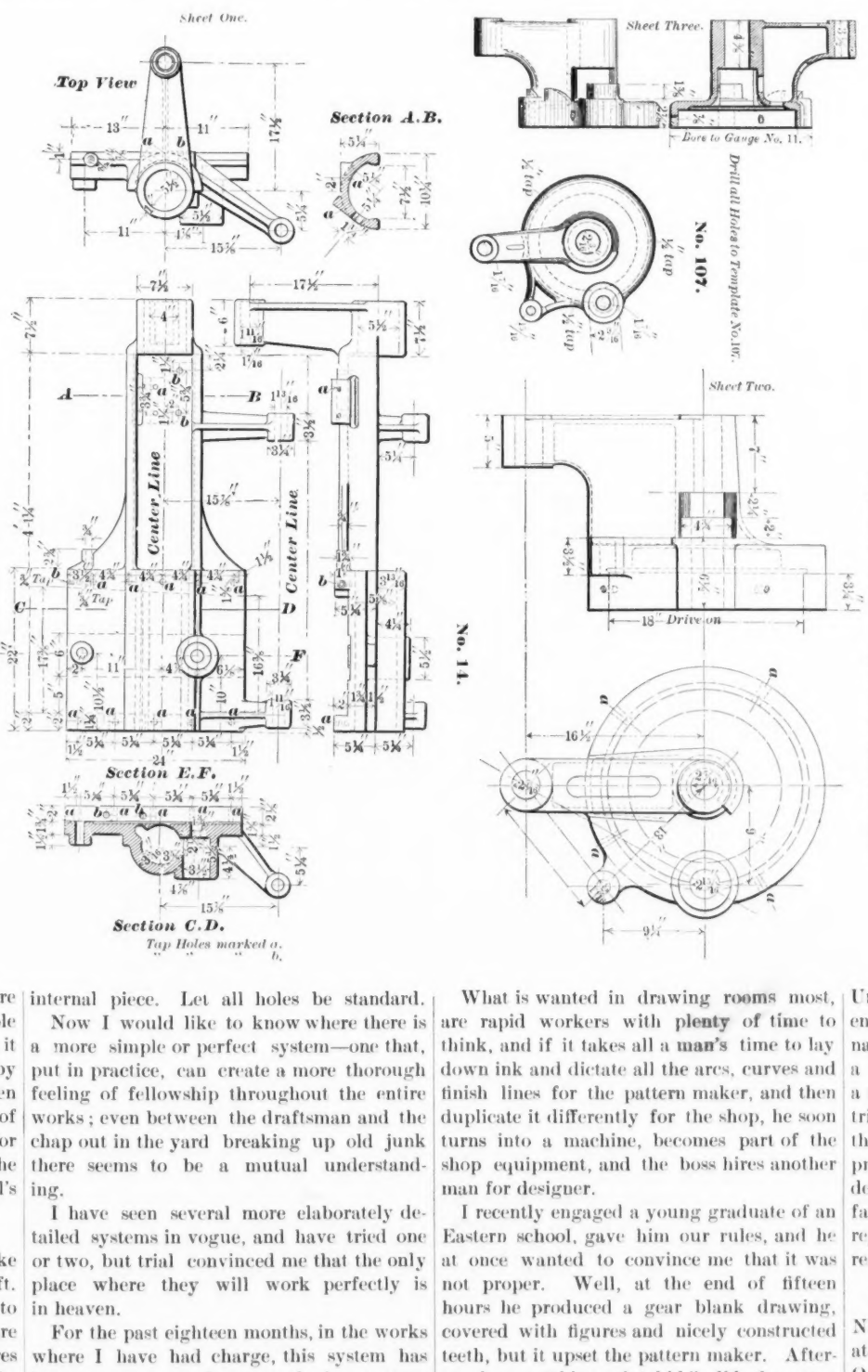
How to Reduce Drawing Room Expenses.

By W. S. Rogers.

What I have to say must not be taken for a lecture on the present method of instruction in schools of drawing, for I make no claims either as lecturer or instructor. I shall simply tell what I have seen, found out, and how I do it, thereby expecting to help others who are pressed for time and want the easy way. But the fact of my being so far out of the beaten track laid down to the scholar, leads me to expect a kick on the part of the masters of drawing.

In the first place I have always given the pattern maker and the man that bossed the shop credit for knowing as much about their branch of work as I was supposed to know about my own; but even this did not help me in reducing the amount of work on a drawing. My own experience in the shop had taught me the fewer figures there were on a drawing the less time was lost by the hands in studying it, and the less chance there was for errors; and with a quick conception of the work, and no excuse for asking questions on the part of the hands, the more rapid and greater the employer's profits.

But where to begin, and how, were the questions that worried me for a long time. Every effort made in any direction was like sailing without a compass, until, by good fortune, I was employed in a drawing room in which, years ago, that king of mechanics, "Chordal," had charge, and one day, while poking in the dusty pigeon-holes of an old closet, I found a mine of treasure. In fact, the nugget was so big, that, after two years of enjoyment of it, I want to divide up with every fellow that wants an easy way to get rid of lots of work by giving it to the other fellows to do—bearing in mind constantly that our co-workers in the pattern room and the shop must be credited with better knowledge of their business than any one else, and all appearance of dictation on our own part must be avoided. Then with "Chordal's Code" (as I term it) in full force, we will be surprised at the total absence of all the petty annoyances and worry, so common in many drawing rooms. I would like to remark right here that I never recommend this system to people wearing very small hats For some reason it always fails to work. Here are the rules by which "Chordal," years ago, lifted the men under him one notch higher in the plane of mechanics, and made each one a thinker for himself, thus saving time and worry in the drawing room. I call them "Chordal's Code."



INSTRUCTIONS.

To Pattern Makers.—Measure and make your allowance for shrinkage and draft. Holes with no size given are to be cored to size. Do not measure where figures are given. Always add for finish when figures are given. Add for finish when you find the word "polish." Where two views are shown, the size is generally marked in but one place; the same with holes of the same character; look out for this. Don't forget the fillets and rounds on all round work. Mark all patterns, core-boxes and pieces, with a symbol and number. Two ciphers before a number mean brass. If one pattern makes two pieces with additions, put both numbers on the piece used for the two.

To Blacksmiths.—Work to the figures and allow for finish, except where you find the word "rough."

To Machinists.—Do not finish where there are no figures, unless you find the word "finish" or "polish," or have special instructions. Where nuts and boltheads come down on rough castings, you will counterbore the surface so as to allow them to come down square. Countersink the first thread out of all tapped holes, not with a drill, but a hand countersink. Touch all bolt holes lightly with the same tool. Chamfer the first thread off all screws before trying them in a hole. Leave no ragged corners. Where a corner is formed by a rough surface and a finished one, round the corner nicely and boldly. A hole marked "tap" is to have a thread in it, either tapped or chased. All screws are right-hand V unless otherwise mentioned. All key sets in shafts are to be in depth one-quarter their width, unless otherwise stated. Don't polish any work not marked polish, except on special instructions. Where a hole to be drilled is shown and no distances are given, it is either to be scribed from some other piece, or is to be in the center of a boss. Make all fits by varying the size of the internal piece. Let all holes be standard.

Now I would like to know where there is a more simple or perfect system—one that, put in practice, can create a more thorough feeling of fellowship throughout the entire works; even between the draftsman and the chap out in the yard breaking up old junk there seems to be a mutual understanding.

I have seen several more elaborately detailed systems in vogue, and have tried one or two, but trial convinced me that the only place where they will work perfectly is in heaven.

For the past eighteen months, in the works where I have had charge, this system has been supreme; and not employing a corps of pattern makers, our work is let out by contract, consequently several different firms have tried it. I have always sent the "Code" with every job to the different pattern shops, and not a single instance has there been where a pattern maker came back for assistance. In fact, a short time ago I had an assistant in the drawing room, who would not work to any rules but his own, and the first drawing he made brought the owner of the pattern shop, that was doing the work, around to see if I was getting dissatisfied with his way of doing work.

Here is a drawing (sheet 1) made according to what I term the "professor's method." Here is a drawing (sheet 2) made according to "Chordal's Instructions," and it does not take a great deal of time to see which is the easiest to make and quickest to comprehend, and following the rules closely, it is but a step to make a still simpler and safer drawing (see sheet 3) for the shop where work is being duplicated constantly and a standard established, whereby the workman's chances of spoiling a piece are reduced to a minimum, and his ability to produce more work without taxing his brain or increasing the pay roll is increased to the highest point.

This is the standard I have tried to establish and leave to my successor to carry out to completion, and if he is guided by "Chordal's" laws as I have been, he will save bottles of ink, and will unload all the minor bothers on the man in charge of the pattern room, and that other mechanic in the machine room, thus finding plenty of time to think up new designs and schemes.

What is wanted in drawing rooms most, are rapid workers with plenty of time to think, and if it takes all a man's time to lay down ink and dictate all the arcs, curves and finish lines for the pattern maker, and then duplicate it differently for the shop, he soon turns into a machine, becomes part of the shop equipment, and the boss hires another man for designer.

I recently engaged a young graduate of an Eastern school, gave him our rules, and he at once wanted to convince me that it was not proper. Well, at the end of fifteen hours he produced a gear blank drawing, covered with figures and nicely constructed teeth, but it upset the pattern maker. Afterward my "blue-print kid" did the same work in an hour, and all he knows was learned from J. G. A. Meyer and "Instructions." He let the gear cutter construct the teeth to the proper curve.

One of the young men in our shop took a night course in mechanical drawing at an institute in our city, and, being anxious to get into the drawing room, designed a taper attachment for a lathe, to show his ability. He was disgusted when we told him he was worth four dollars a week in there, and I expect there might be considerable merit in his device if it could only have been understood. These experiences and many others lead me to ask, why not, instead of the elaborate systems of section lining and shade lines that are being taught us, and which only tend to increase the cost of drawings, take the simple rules laid down by "Chordal" to make things clear and plain to the men under him, and lighten his own labor, and adopt them as a standard known as "Chordal's Code for Mechanics"?

Boiler Patching Extraordinary.

A boiler explosion which recently occurred on board the Yarmouth trawler "Proceed," causing the death of two men and severe injury to several others, is an example of the outrageous conditions under which steam is sometimes employed by uneducated people. The "Proceed," in common with most modern Yarmouth smacks, is fitted with a steam capstan for getting in the net. On the particular voyage during which the explosion occurred, instructions were given by the owner that the capstan should be worked by hand, as the boiler was known to be unsafe, the uptake being badly burnt, probably from neglect in blowing off and lowness of water, the engine being worked non-condensing. The firm who were to supply a new boiler had purposely knocked a hole in the uptake to prevent its use, and the owner of the boat had sent extra hands to sea to work the capstan. It would therefore seem that every precaution had been adopted to prevent the use of the boiler. With an ingenuity worthy of a better cause, however, the crew proceeded to patch the hole in the uptake with an old paint tin, canvas, and red lead, the whole being well lashed with rigging chain. With this original and unique style of boiler repairs, four hauls were made, steam being adjusted by men at the capstan bars. At the fifth haul, with steam at about 30 lb. pressure (by the gauge), the patch blew off, with the results we have stated, the only wonder being that the patch held on for so long. The coroner's jury exonerated the owner, and found that deceased's death was due to the negligent use of the boiler, adding to their verdict a recommendation that the local clubs in which smacks are insured should appoint competent inspectors to periodically examine the boilers at short intervals.—*The Engineer and Iron Trades Advertiser.*

It is undoubtedly true, as stated, that the material used in the construction of the new vessels for the United States Navy is superior to that entering into the construction of any other navy in the world. Uncle Sam has been a little tardy in the matter of providing a navy, but no rash experiments are being tried, and a good deal has been learned by the failure of others. On the whole it is probable that nothing has been lost by the delay, if the work is now pushed ahead as fast as is practicable. Patriotic citizens will rejoice when the American navy is once more respectable.

The following officers were elected by the National Association of Stationary Engineers, at their Milwaukee meeting: President, R. O. Smith, of New York; Vice-President, John Fehrenbatch, of Cincinnati; Secretary, J. R. Moore, of Minneapolis; Conductor, —— Edge, of Atlanta; Doorkeeper, —— Bailey, of Omaha. The association did some good work in the way of revising the constitution, and other work that came before it. The next meeting of the association will be held at Detroit.

Altogether, the meeting at Milwaukee was a very successful one in every respect; it demonstrated that the National Association is in a flourishing condition.

Practical Drawing.

By J. G. A. Meyer.

SIXTIETH PAPER.

494. In working drawings we are sometimes compelled to show, besides the view of the cylindrical surface given in Fig. 374 (59th paper) another view of the same surface, such as is shown in Fig. 377. The projection given in this latter figure represents the appearance of the cylindrical surface when viewed in a direction as indicated by arrow 2. In Fig. 377 the circumference of the circle c_7 d_7 5*c* 6*c* represents the vertical projection of the curve in which the given cutting plane intersects the cylindrical surface. But the vertical projection of such an intersection can only be a circumference of a circular in particular cases, because the form of the vertical projection of the curve will depend on the relative position of the given cutting plane, and the relative position of the axis of the cylinder to the planes of projection; hence we have the following three cases.

495. When the axis of the cylindrical surface with a circular base stands perpendicular to the horizontal plane of projection, and the given cutting plane also stands perpendicular to the same plane, but forming an angle of 45 degrees with the horizontal plane projection, the vertical projection of the curve of intersection on the plane *C D*, and consequently in Fig. 377, will be the circumference of a circle.

In this case the trace *d e* (Fig. 374) of the given cutting plane will form an angle of 45 degrees with the ground line *A B*.

496. When the axis of the cylinder with a circular base stands perpendicular to the horizontal plane of projection, and the given cutting plane also stands perpendicular to the same plane, forming an angle *less* than 45 degrees with the horizontal plane of projection, then the vertical projection of the curve of intersection on the plane *C D*, and consequently in Fig. 377, will be an ellipse, whose major axis is equal to the diameter of the cylinder, and its minor axis less than the same diameter. In this case the trace *d e* (Fig. 374) of the given cutting plane will form an angle less than 45 degrees with the ground line *A B*.

497. When the axis of a cylinder with a circular base stands perpendicular to the horizontal plane of projection, and the given cutting plane stands perpendicular to the same plane, forming an angle *greater* than 45 degrees with the horizontal plane of projection, then the vertical projection of the curve of intersection on the plane *C D*, and consequently in Fig. 377, will be an ellipse whose minor axis is equal to the diameter of the cylinder, and its major axis greater than the same diameter.

498. In the first case, we do not need to find points in the vertical projection of the curve shown in Fig. 377; all we need to do is to find the correct position of the center of the circle, and then describe the circumference. But in the last two cases we must find points in the curve, hence the following problem, which will cover both cases.

Problem 73*a*.

To find the vertical projection of the intersection made by a plane with a cylindrical surface.

Let b_3 c_3 5*a* 6*a*, Fig. 375, be the horizontal, and *b* b_3 *c* c_3, Fig. 374, the vertical projection of a cylindrical surface whose axis is perpendicular to the horizontal plane of projection. This cylindrical surface is intersected by a given plane which stands perpendicular to the vertical plane of projection, and inclined towards the horizontal one to any given angle. It is required to find on the plane *C D* the projection of the curve in which the plane intersects the cylindrical surface, so as to obtain a view as is shown in Fig. 377.

In order to obtain the projection given in Fig. 377 we assume, as explained in Art. 399, that the cylinder is first projected on the plane *C D*, this plane is then revolved around the axis represented by the point *C*, until it coincides with the ground line *A B*; after this, it is revolved around the ground line *A B* until it coincides with the plane of the paper, so as to bring the outline of the cylinder or its projection on the plane *C D* into full view. This being understood, we proceed and find the required projection of the curve in the following manner:

In Fig. 377 draw the center line c_7 b_9. Through the points *c* and *b* (Fig. 374) draw horizontal lines, cutting the line c_7 b_9 in the points c_7 and b_7. Also through the points of division 1*b*, 3*b*, 5*b*, 7*b* and 9*b*, draw horizontal lines, and let these extend a little beyond the center line c_7 b_9. Make the length of the line 1*c* 2*c* (Fig. 377) equal to the length of the line 1*a* 2*a* (Fig. 375); 3*c* 4*c* equal to 3*a* 4*a*; 5*c* 6*c* equal to 5*a* 6*a*, and so on; the middle point of each one of the lines 1*c* 2*c*, 3*c* 4*c*, etc., must lie on the center line c_7 b_9. Through the points b_7, c_7, and also through the points 1*c*, 2*c*, 3*c*, 4*c*, etc., which are extremities of the lines 1*c* 2*c*, 3*c* 4*c*, etc., draw a curve; this curve will be the vertical projection of the intersection made by the given plane with the cylindrical surface.

If the given cutting plane *d e* makes an angle of 45 degrees with the horizontal plane of projection, the distance between the points c_7 and b_7, in Fig. 377, will be equal to the diameter of the cylinder; if the given cutting plane makes an angle less than 45 degrees with the horizontal plane of projection, the distance between points c_7 and b_7 will be less than the diameter of the cylinder; and lastly, if the given cutting plane makes an angle

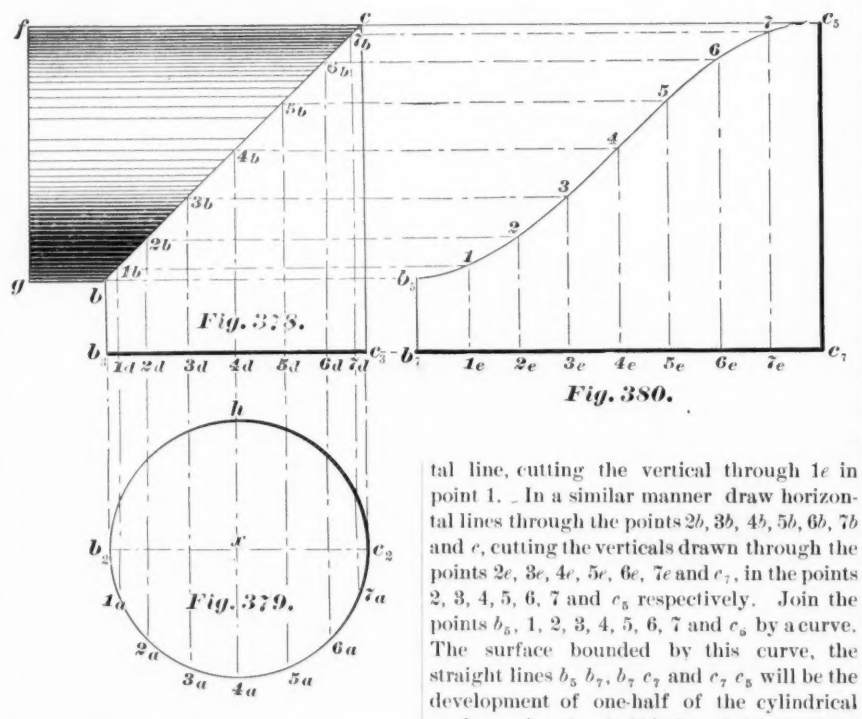


Fig. 378. *Fig. 379.* *Fig. 380.*

greater than 45 degrees with the horizontal plane of projection, the distance between the points c_7 and b_7 will be greater than the diameter of the cylinder.

Directions.—Divide another sheet of drawing paper into the same number of spaces as was done on previous sheets, and mark these spaces, Prob. 73, Prob. 74, etc. In the space marked Prob. 73 draw the vertical and horizontal projection of a cylindrical surface, such as is shown in Figs. 374 and 375. The line *d e*, that is the trace of the given cutting plane, is to make an angle of 30 degrees with the ground line *A B*. The length of the element *c* c_3 is to be 42 inches, diameter of the cylinder 36 inches. Find the true form of the curve of intersection as shown in Fig. 376; and also the vertical projection as shown in Fig. 377. Use ½ inch scale.

Problem 74.

499. *Development of cylindrical surfaces.*

Let *b b c* c_3 and *c b f g*, Fig. 378, be the vertical projection (or elevation) of two cylindrical surfaces with circular bases meeting each other in a plane, as shown. The dimensions of one surface are equal to those of the other. It is required to find the development of these surfaces.

Under the given conditions the development of one cylindrical surface will be equal to that of the other. Hence in the following construction we shall only find the development of the cylindrical surface *b* b_3 *c* c_3.

From any point, as *x* (Fig. 379), as a center, taken on the line 4*b* 4*a*, that is, the center line 4*b* 4*d* prolonged, describe a circle whose diameter is equal to the diameter of the given cylinder. Draw the diameter b_3 c_3 perpendicular to the center line 4*b* 4*a* and divide the semi-circle b_3 4*a* c_3 in any number of equal parts, say eight; through the points of division 1*a*, 2*a*, 3*a*, etc., draw vertical lines intersecting the base b_3 c_3 (Fig. 378) in the points 1*d*, 2*d*, 3*d*, etc., and also intersecting the line *b c* in the points 1*b*, 2*b*, 3*b*, etc.

Prolong the base b_3 c_3 towards c_7 (Fig. 380); from any point b_7 on this line lay off a point c_7; the distance between the points b_7 and c_7 must be equal to the length of the semi-circumference b_3 4*a* c_3 (Fig. 379). This distance should be found by calculation, thus: Multiply the diameter b_3 c_3 by 3.1416, and divide the product by 2; the quotient will be the distance between the points b_7 and c_7. If, for instance, the diameter b_3 c_3 is equal to 30 inches, then the distance from b_7 to c_7 will be equal to

$$\frac{3.1416 \times 30}{2} = 47.124,$$

or very nearly equal to 47¼ inches. Divide the line b_7 c_7 into the same number of equal parts as spaced off in the semi-circumference b_3 4*a* c_3, and through the points of division 1*e*, 2*e*, 3*e*, etc., draw vertical lines. Through the point *b* (Fig. 378) draw a horizontal line, cutting the vertical line through b_7 (Fig. 380) in the point b_5; through 1*b* draw a horizontal line, cutting the vertical through 1*e* in point 1. In a similar manner draw horizontal lines through the points 2*b*, 3*b*, 4*b*, 5*b*, 6*b*, 7*b* and *c*, cutting the verticals drawn through the points 2*e*, 3*e*, 4*e*, 5*e*, 6*e*, 7*e* and c_7, in the points 2, 3, 4, 5, 6, 7 and c_5 respectively. Join the points b_5, 1, 2, 3, 4, 5, 6, 7 and c_5 by a curve. The surface bounded by this curve, the straight lines b_5 b_7, b_7 c_7 and c_7 c_5 will be the development of one-half of the cylindrical surface; the other half is found in the same manner, and will be exactly equal to the development already found. Of course the curve in the half development not shown will commence at the point c_5, and gradually approach the horizontal line b_7 c_7 prolonged, making the length of the last element, which corresponds to the element b_5 b_7, equal to the length of b_5 b_7.

The method for finding the development of a right cylindrical surface with circular base has been explained, also the reason for finding the length of the line b_7 c_7 (Fig. 380) by calculation given in Problem 58.

The points b_3, 1*a*, 2*a*, etc. (Fig. 379), represent the horizontal projection of elements in the cylindrical surface, the lines *b* b_3, 1*b* 1*d*, 2*b* 2*d*, etc., represent vertical projections of the same elements; that is to say, the point b_3 and the line *b* b_3 are the horizontal and vertical projections of one and the same element; the point 1*a* and line 1*b* 1*d* are the projections of another element, and so on. In Fig. 379, the arcs b_3 1*a*, 1*a* 2*a*, 2*a* 3*a*, etc., represent the true distances between the elements; in Fig. 378, the length of the lines *b* b_3, 1*b* 1*d*, 2*b* 2*d*, etc., represent the true lengths of the elements. In rolling a right cylinder along a flat surface the extremities *b*, 1*d*, 2*d*, etc. of the elements fall in a straight line; in the case before us they all fall in the line b_7 c_7. This must be obvious, from the fact that when a right cylinder is rolled along a straight surface, the cylinder will travel in a direction of a straight line; and furthermore, according to the definition of a right cylinder (see Art. 299) the elements are, and consequently its axis is, perpendicular to the bases, consequently any point in the base of the cylindrical surface, as b_3 for instance, must describe a straight line in rolling the cylinder along a straight surface; we therefore conclude that all the extremities b_3, 1*d*, 2*d*, etc., must fall, in the development, in one straight line. For this reason we commence the development by drawing the straight line b_7 [illegible] in Fig. 380. The points b_7, 1*e*, 2*e*, etc., placed at distances from each other equal to one of the arcs 1*a* 2*a*, 2*a* 3*a* or 3*a* 4*a*, represent the lower extremities of the elements in the developed surface; the lines drawn through the points b_7, 1*e*, 2*e*, etc., whose lengths are made respectively equal to the lengths of the lines *b* b_3, 1*b* 1*d*, 2*b* 2*d*, etc., as is plainly shown by the horizontal lines *b* b_5, 1*b*—1, 2*b*—2, etc., will represent elements of the cylindrical surface in the development of the same; and consequently the curve drawn through upper extremities b_5, 1, 2, etc., of the elements, will be one of the boundary lines of the development of the cylindrical surface as far as we have shown it.

The student may probably obtain a better idea of this problem by making a small wooden cylinder, and cutting off a portion of it, as shown by the line *b c* in Fig. 378. Then tightly cover the cylindrical surface with a piece of paper, allowing the paper to extend from the base b_3 c_3 to the upper surface *b c*, no more and no less. The circumference of the circle b_3 c_3 *h* 4*a*, Fig. 379, will be the horizontal projection of the paper, and the outline *b* b_3 *c* c_3 (Fig. 378) will be its vertical projection. Now on the surface of this paper draw sixteen straight lines; these lines will of course be perpendicular to the base b_3 *c*, because any line not perpendicular to the base cannot be a straight line. The lines drawn on the paper may be assumed to be elements of the cylindrical surface. In the horizontal projection, or in other words in the top view, Fig. 379, the ends of the elements can be seen and are represented by the points b_3, 1*a*, 2*a*, etc. In the elevation or vertical projection, Fig. 378, the lines drawn on the paper will appear as represented by the lines *b* b_3 1*b* 1*d*, 2*b* 2*d*, etc. If we now spread out the piece of paper and lay it on a straight surface, on which the development has been drawn, so that the bottom edge of the paper will coincide with the line b_7 c_7, then the curved boundary line of the paper will coincide with the curve b_5 c_5, and the elements represented by the lines drawn on the piece of paper will coincide with the lines drawn through the points b_7, 1*e*, 2*e*, etc.; thus showing plainly that the curved line drawn through the extremities b_5 1, 2, etc., of the elements must be one of the boundary lines in the development of the cylindrical surface. Of course only one-half of the paper will cover the development shown in Fig. 380, the other half of the paper will extend beyond the line c_5 c_7.

Directions.—In space marked Problem 74 draw the vertical and horizontal projection of a cylindrical surface 29 inches in diameter, its longest element 33 inches, and the shortest element 12 inches. Find one-half of its development. Use ½-inch scale.

A correspondent of the *London Times*, writing on the subject of the daily race between the two fast English trains, says:

There is one point of which I have seen no notice taken—the increased wear and tear, mentally and bodily, of the driver and stoker on these special trains. A friend of one of the drivers told me that he saw a marked effect on his apparent health. The driver told him his anxiety was greatly increased. On one occasion his stoker, who had gone along the engine to oil a valve, became paralyzed with fear, so that he could not move forward or backward. The driver had to leave his place and follow his stoker and seize his hand, and so they regained the standing place. The distances run are so great and the pace so rapid that any oiling, etc., is done with increased risk. The force of the wind is so great that when the stoker creeps along the footplate alongside of the engine he has to hold on by the rail like grim death, and has been carried off his feet.

One hundred and twenty-two passenger trains leave the Grand Central depot, at New York, daily.

The Waterhouse Instantaneous Automatic Regulator.

We present with this, engravings representing this regulator, for which patents have been allowed to Addison Waterhouse, and assigned by him to the Waterhouse Electric and Manufacturing Co., Hartford, Conn. Thousands of machine shops and factories throughout the country will in the next few years adopt the electric light as an illuminant, for they find that a well-lighted shop increases production. In many of these factories the power is unsteady, and it will be found desirable to belt to the line shaft and operate a dynamo to produce the light, and a regulator for the current is therefore of paramount importance. The Waterhouse regulator is designed to compensate for any variation in speed, maintaining at all times the standard current on the line. The following description will enable those not familiar with the subject to understand the workings of the regulator.

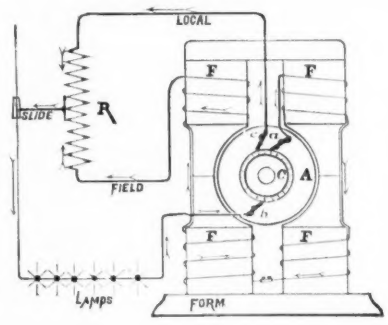
In the small figure is represented a diagram of the Waterhouse type of dynamo, with a closed circuit armature *A*. On the commutator *C* are three brushes; *a* and *b* are the main circuit brushes and *c* the auxiliary brush. From the positive brush *a* the current passes to the conductor around the field magnets *F* to the resistance *R*. The current from the auxiliary brush *c* passes directly to the resistance *R*, leaving the field magnets out of circuit. The current from both circuits (field and local) joins at *R*, and passes to the lamps, the current on the lamp line being the sum of the two. The amount of current in the field and local circuits is in proportion to the resistance *R* in each.

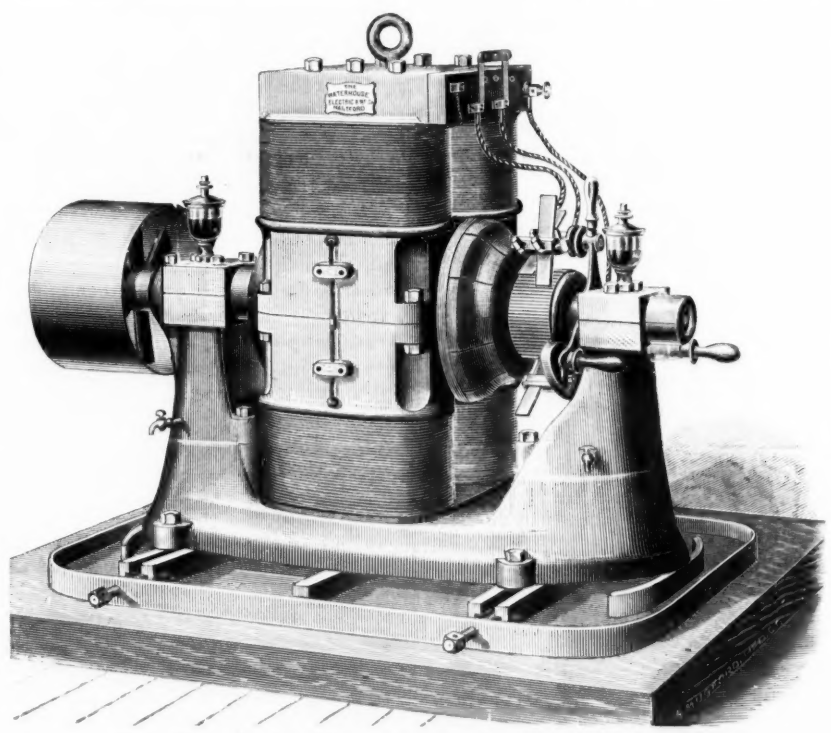
There is in every dynamo a point of maximum commutation on the armature, which changes with the resistance on the lamp line, moving with the rotation (towards brush *c*) when the resistance decreases, and back when it increases. This affects the current in the local and field circuits as follows: When lights are turned out the line resistance is decreased and the maximum point moves forward and forces more current out of brush *c* and less of brush *a*. This reduces the current in the field magnets and the E.M.F. (pressure) in the circuit, and consequently the power required to operate the dynamo. But the current on the lamp line remains constant, because the local circuit is increased proportional to the decrease of the field circuit. The remaining lamps therefore retain their full brilliancy, while the current cannot increase and destroy the apparatus. Thus the very tendency of the machine is to perfect regulation without the aid of a mechanism; but when to this is added the simple regulator, which makes the regulation instantaneous by assisting the current to pass out at brush *c* and opposing its passage around the field magnets by way of brush *a* when lights are cut out, and forcing it out at brush *a* around the field magnets by opposing its passing out at brush *c* when lights are cut in, the efficiency of the method can be appreciated.

The regulator is illustrated by the slide in the small figure, which is controlled by a solenoid. Any tendency of the current to increase raises the slide, and the result is a decrease of resistance in the local circuit and an increase of the resistance in the field circuit. More current will therefore flow through the local circuit and less through the field circuit. The generating capacity of the dynamo is instantly reduced, and any tendency to produce a current above the standard is overcome. Should the tendency of the current be to decrease, say by a reduction of the speed of the armature, the slide lowers, increasing the resistance in the local, and reducing it in the field circuit. More current will then flow around the field magnets and less out on the local circuit. The generating capacity of the dynamo will therefore increase, to maintain the current at standard. It should be stated that the use of resistance for balancing the field and local circuits is a small amount compared to that used by the lamps, and is not interposed, as can be seen, for the purpose of compensating for lamps turned off.

The Waterhouse regulator varies the E.M.F directly with the resistance of the lamp line, producing self-regulation and maintaining on the lamp line the standard current, whether one lamp or the full number are burning. By this method, as the lamps are cut out the current is reduced in the dynamo, even to the fraction of an ampere, and it is apparent that one light on the Waterhouse dynamos can be maintained for any length of time without producing more than the standard current.

The automatic regulator is furnished with small and large plants of the Waterhouse system, from three lights up, and is applied to the dynamo represented in the large figure.





THE WATERHOUSE INSTANTANEOUS AUTOMATIC REGULATOR.

Notes on the Expansion of Steam.

BY RICHARD H. BUEL.

ELEVENTH PAPER.

Superheated steam is formed by heating saturated steam, either in the steam space of a boiler or in a separate vessel or superheater. The effect of superheating is to increase the volume of the steam, if the pressure is maintained constant, to increase the pressure at constant volume, or to increase both volume and pressure under suitable conditions. In ordinary practice, steam is superheated at constant pressure, so that its temperature and volume are increased.

Superheated steam has often been used in the cylinders of steam engines, and considerable economy has generally resulted therefrom. In some cases the superheat has been so excessive as to dry up the oil in the cylinders and produce cutting, and superheaters have frequently burned out, owing to faulty design. For some reason or other, perhaps for causes similar to those just enumerated, the use of superheated steam has been greatly restricted, and one of the most economical methods of using steam for power has been generally overlooked by steam users. This may be partly on account of prejudice, and partly from ignorance, for the most extravagant notions about superheated steam seem to prevail among persons who are otherwise well informed. As long ago as 1859, superheaters were placed in several English steamers, with the result of saving between 25 and 40 per cent. of coal, the records being taken from the logs of several voyages.

The experiments of Mr. George Basil Dixwell, using a cylinder pyrometer which indicated variations of temperature during each stroke of the engine, showed that for every initial pressure and point of cut-off there was a definite amount of superheat which could be employed without injury to the cylinder and without danger of burning the oil. When the steam was superheated to the proper degree, the temperature of the cylinder was constant throughout the stroke, as indicated by the pyrometer. This amount of superheat was found sufficient to prevent the formation of water within the cylinder; that is to say, it supplied sufficient heat for the condensation due to work, and for the condensation due to external radiation. Under these circumstances the amount of steam used by the engine would be the same as that calculated from the piston displacement; and if the steam were superheated by the products of combustion, the saving in fuel by the use of a superheater would be equal to the amount of coal burned in generating the steam condensed for work and by external radiation. Sometimes the steam is superheated by a separate furnace, but the more usual method is to place the superheater in the boiler flue, so that there is no fuel required for superheating.

If the superheating is carried beyond the temperature required for preventing condensation, a still greater saving will be effected—because, in this case, the volume of the steam will be sensibly increased, so that the weight of steam necessary to fill a given space will be less than before. But with such experimental data as have been obtained up to the present time, it does not seem desirable to increase the temperature of superheat much beyond the temperature required for preventing condensation; and the problem presented for consideration in this discussion is the manner of determining the aforesaid temperature for the assumed cases of cut-off, it being supposed that the expansion takes place in the same manner as was assumed in the first problem—the unjacketed cylinder with saturated steam—so that the mean pressures, power, and steam calculated by piston displacement, will be the same as in the first case.

In explaining the manner of finding the temperature of superheat required, under the assumed conditions, one example will be worked out in detail, as was done in previous cases, and then the analytical formulas will be presented—the case chosen for illustration being, as before, that in which the apparent cut-off is $\frac{1}{4}$, and real cut-off .274.

The terminal pressure of steam is the product of the pressure at point of cut-off (97.5) multiplied by the cut-off (.274), or

$97.5 \times .274 = 26.7$ pounds per square inch.

The volume of a pound of steam at this pressure is 15.04 cubic feet. The mean pressure up to point of cut-off is 98.75 pounds per square inch, and the volume of a pound of steam at this pressure is 4.39 cubic feet.

The work done by each pound of steam is the difference between final and initial volumes ($15.04 - 4.39 = 10.65$) multiplied by 144 times the mean pressure during expansion in pounds per square inch (47.6) or

$$10.65 \times 144 \times 47.6 = 73,342$$

foot-pounds; and the units of heat required for this work are $\frac{1}{772}$ of the work, or

$$\frac{73,342}{772} = 95 \text{ British thermal units.}$$

The total heat above 32° Fahrenheit per pound of saturated steam at the terminal pressure, 26.7 pounds per square inch, is 1,156 British thermal units, and adding the heat required for the work of expansion (95), the sum is the total heat above 32° Fahrenheit per pound of steam superheated sufficiently to prevent the condensation due to work, or

$1,156 + 95 = 1,251$ British thermal units.

The temperature of superheat corresponding to this total heat at terminal pressure is calculated in the following manner:

Subtract 1,075 from the total heat above 32° (1,251), and divide the difference by .4,805.

To this quotient add 32, and 20.403 times the 4th root of the pressure (26.7), or

$$\frac{1,251 - 1,075}{.4,805} + 32 + 20.403 \times \sqrt[4]{26.7} =$$

445° Fahrenheit.

It is assumed that an additional superheat of 50° Fahrenheit will be sufficient to cover all losses by radiation, making the final temperature of superheat 495°, corresponding to an amount of superheat equal to the difference between the last temperature and the temperature of saturated steam at initial pressure (328°), or

$495° - 328° = 167°$ Fahrenheit.

The amount of steam used hourly, calculated by piston displacement, and already determined in the case for unjacketed cylinder and saturated steam, is 3,328 pounds, and the effective horse-power, as determined for the same case, is 150.6, so that the probable consumption of steam hourly per effective horse-power for the present case, where the use of superheated steam is supposed to prevent all losses from condensation due to the work of expansion and radiation, is

$$\frac{3,328}{150.6} = 22.1 \text{ pounds;}$$

representing a saving over the case in which saturated steam was used in an unjacketed cylinder of

$$28 - 22.1 = 5.9 \text{ pounds, or}$$

$$\frac{5.9 \times 100}{22.1} = 26.7 \text{ per cent.}$$

The general formulas and results for all the cases, when superheated steam is used, will next be presented.

A Memorial Engine.

A recent issue of *Industries* contains cuts and a description of an engine which is remarkable in many respects, and is a very good example of adaptation to special requirements, although as an engine for developing power under ordinary circumstances it would probably not prove very successful.

It is called the "Thomas Russell Memorial" steam engine, and was built to the designs of Professor Jamieson, by Hall, Russell & Co., of Aberdeen, and presented to the Glasgow and West of Scotland Technical College, by Mrs. Russell, widow of the late well-known mechanical engineer, John Russell, who died about two years since.

The engine is arranged to work (1) as a non-condensing, (2) as a jet condensing, and (3) as a surface condensing engine; the bed of the engine being in the form of a comparatively large box, which contains the condensers and air pumps. The only statement we find in the description by our contemporary, to indicate the size of the engine, is that steam is supplied to it by a 2-inch pipe, and it is intended to work at an initial pressure of 100 pounds.

The main slide valve has two expansion valves fitted to its back face, which may be separately adjusted to cut off at any desired point between 10 and 70 per cent. of the stroke. By this arrangement the steam may

be cut off at half stroke in one end of the cylinder, while at the other end the point of cut-off may be varied at will while running, and successive indicator diagrams taken, at .1, .2, .3 and so on up to .7 of the stroke; or the cut-off can be made equal at each end of the cylinder.

There is a link motion which is fitted with a counterbalance weight, to facilitate easy reversal and handling, and to enable diagrams to be taken, showing the effects of different positions of the link.

The eccentrics which give motion to the main and expansion or cut-off valves are so arranged that the "angle of advance" can be changed at pleasure to show the effects upon steam distribution.

The cylinder is steam-jacketed all round, including the heads, all three jackets being supplied with steam from the main steam pipe.

By means of drain pipes leading from each jacket, and fitted with cocks, the water of condensation can be drawn from the jackets, and flows into a small measuring tank, so that its exact weight can be ascertained.

Two plates are fitted to the inside of each cylinder head, and secured in place by screws, so arranged that one or both plates may be removed from either or both heads, the effect being to increase the clearance spaces from 10 per cent. of the piston displacement to 15 per cent. with one plate removed, or 20 per cent. with both plates removed; the object being to afford means of demonstrating the effect of different amounts of clearance.

The piston is fitted with ramsbottom cast-iron rings. The crosshead is of the slipper form, and the upper faces of the guides are graduated in tenths of the stroke, so that the position of the piston can be ascertained at a glance, when re-setting valves, or for inspection of the relative positions of the valves and other moving parts.

The fly-wheel is 4′ 6″ diameter, and in one of the arms is a sliding weight, which may be moved to any desired position on the arm by means of a screw, so that the balance of the wheel may be disturbed to show the effects of want of balance. On this fly-wheel is fixed a brake used for determining the horse-power by brake tests.

By means of a four-way valve the exhaust steam can be turned into either of the condensers (surface or jet), or it can be turned into the atmosphere. The water which circulates through the tubes of the surface condenser is taken from the municipal supply and passes through a meter.

Specially constructed thermometers are provided, by which the temperature of the condensing water, as it enters and as it leaves the condensers, can be accurately determined. In the same way the temperature of the steam on admission and when exhausting can be observed. The thermometer used consists of a mercurial bulb and tube, fixed into a brass tube, which is partly filled with oil, and fitted with an india-rubber stopper. The brass tubes are screwed permanently into their positions and are not removed, the thermometers being placed inside of them only when temperatures are to be ascertained. There is a specially constructed combination revolution counter and speed indicator, driven by a belt from a collar on the crank-shaft, and so placed as to be easily seen from the working levers.

All bright parts of the engine have been electroplated with nickel, and no pains spared to make the workmanship the best.

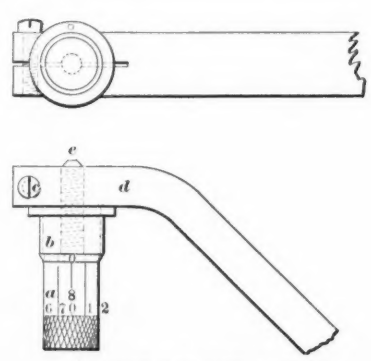
Altogether, the engine seems admirably designed for the purpose intended, and will undoubtedly afford opportunity for studying the action of steam engines under varying conditions much better than can be done in schools having but one engine, and that not built with special reference to the needs of students. It constitutes a very appropriate memorial for an engineer of whom it is said that he took an especial interest in apprentices and students of engineering with whom he was thrown in contact. And the example afforded by this gift is one that could be well considered by others desirous of advancing the science of steam engineering.

LETTERS FROM PRACTICAL MEN.

A Device for the Lathe.

Editor American Machinist:

I have read a number of articles in your valuable paper in regard to setting a lathe to turn straight, etc. I have devised a small tool for the purpose, which will do all it is intended to do, and I enclose sketch of the same. It consists of a screw (*a*) which has 16 threads per inch. The end (*a*) is divided into 8 equal parts, so that one revolution moves the screw $\frac{1}{16}''$, one-half $\frac{1}{32}''$, one-quarter $\frac{1}{64}''$, one-eighth $\frac{1}{128}''$. The piece (*d*) is tapped to receive the screw, and is also slotted and closed on screw to take up any lost motion there may be; (*b*) is a sleeve screwed fast to (*d*) with one screw. This sleeve has one mark only, *i. e.*, zero. By placing (*d*) in the tool post the same as a turning tool, and using point (*c*) against the work, a lathe can be set to turn perfectly straight with this by turning a short distance on one end of the work, say 1″; then set the tool at zero, and bring it to touch the work by moving the slide rest. Then turn the screw (*a*) back from the work say one-half turn, change the work on the centers end for end, move the carriage up to live center, and turn the screw (*a*) in until point (*c*) will touch the work, and if the graduations come the same as at the other



A Device for the Lathe.

end the lathe will turn straight. If they do not come the same, the dead center must be moved until they do. It is used also for setting the lathe to turn taper.

Supposing a piece is to be turned with a taper of $\frac{1}{4}''$ to the foot. Take any part of the piece which has been turned straight (or parallel), and mark upon it two points 12″ apart; then, by bringing the point of the screw (*c*) in contact first with one of these points, and then with the other, and adjusting the dead center, it can be determined when the lathe is set to the right taper, which will be when one of the marked places is $\frac{1}{4}''$ further from the center line of the lathe than the other. Of course the screw must be turned back only one-half of the taper. The tool can also be used in a great many ways for testing work, testing the tables of planers and shapers, and for many other purposes.

Philadelphia, Pa. J. S. R.

An Extemporized High Pressure Gauge.

Editor American Machinist:

In the machine shop which I took charge of several years ago was an old hydraulic press which was used for a great variety of purposes. And by the way, I do not know of a greater convenience in a jobbing shop than a "squeezer" for crank-pins and tight fits of every kind. The press in question was used principally in pressing on small car wheels and pressing them off again when worn out. The only objection to the press was that it had to be worked by hand, requiring three or four men, where one could do more work with a power pump. This had often been spoken of, but never materialized until one day I found an old Westinghouse air pump which came in a lot of locomotive scrap. That was all right, for anything I could see, for the purpose I wanted it. I sent it to the shop, took the air cylinder off and reduced the piston-rod as much as the hole in it would allow, bushed the glands to fit the rod, then set it over the old press pump, which had been divested of all its old hand-power paraphernalia. All that was required now was to make steam connections and go ahead. This was done, and everything "moved off" very nicely, except there was no cushion on the up stroke of the pump. A piece of rubber fastened to the top head fixed this defect, but what would have been a convenience before was a necessity now, viz., a pressure gauge. With hand-power, if the fit was too tight or loose it was easily told by the way the pump worked.

My first idea was to put on a safety valve and run the weight out on the lever so the valve would be just kept from "blowing," but one of the shop boys offered a better scheme; he suggested, instead of using a valve, that a piston be put in and a spring scale attached to the end of the lever. The scale was not at hand, and it was also thought that it would require too much movement of the lever to be practical, so, while hunting for something else, an old diaphragm steam gauge was found, which proved to be just the thing.

The first thing now to be done was to find what weight had to be applied to the spring—or diaphragm, rather—to register a pound on the gauge; to do this I put the gauge on a pair of scales, so that whatever weight was applied to the gauge would pass through its spring and also be weighed on the scales. The result was that the gauge and scales registered the same, and very accurately too. I had all the data now that was required to complete the combination, so nothing was left to be done but to apply practically, what theory had suggested. This was done as follows: a tee was put in the pipe leading from the pump to the cylinder of the press, with its branch up; into this was screwed a short piece of brass having a .19″ hole through it, and threaded at the top end to fit the gauge. Before putting on the gauge, a nicely fitted piston was inserted in this brass nipple, which projected up to the spring in the gauge. A small hole was drilled above the piston to carry off what water might leak by it. The area of the ram in the press was 28.27″ and the area of piston acting on the spring of the gauge was .02835″ or as nearly as could be made, the ratio of areas of cylinders was as 1 is to 1,000. So when 15 lbs. was shown on the gauge, the pressure on the ram was 15,000 lbs.

The pressure per square inch was not taken into account at all. The small piston was solid, and leaked considerably when the pressure got up well in the thousands, but some heavy oil was put below the piston, which stopped it very effectually. The whole rig is a complete success, and has paid for itself several times over, the whole cost coming inside of ten dollars. C. O. Sine.

Measuring Screws.

Editor American Machinist:

After reading carefully the paper on screw measurements by "Jarno," I would like to say a few words in regard to the same subject. I noticed also the paper written by Fred J. Miller previously, and would say that the method described by him, using ball points, is not a sure way to measure screws, even by comparison with standard, unless the angles of threads are absolutely alike in both screws. The method shown by Jarno (Fig. 3) is one that has been used by me for a long time, and is practically correct, but not theoretically, as my friend "Jarno" has explained in his paper published by you Sept. 22. The imperfection, however, is less than one ten-thousandth of an inch in a one-inch screw, eight pitch, therefore we do not notice it in practice. With the addition of a table of screw measurements measured at the pitch line, we are enabled to set the caliper to any regular size tap or screw, same as we set our common vernier to measure flat surfaces. "Jarno" says: "A thread *A* comes exactly opposite a space *B* in any screw having an odd number of threads, as one, three, five, etc." I think he certainly overlooked that point when specifying odd numbers of threads only, as if even numbers, as two, four, six threads to the inch be considered, the thread *A* would be opposite the space *B* at the center line as well; if not, we should be limited very much in measuring screws.

Providence, R. I. G. E. W.

In my article referred to above, I gave especial prominence to the necessity for securing the exact angle in the thread, as a necessary condition to accurate measurement of sizes, and with this condition secured I cannot see why any one accustomed to micrometer measurements should not be able to measure screws with a considerable degree of accuracy in that way; in fact, with almost if not quite as much accuracy as ordinary cylindrical work can be measured by the micrometer. Furthermore, it would seem that any inaccuracy of angle or shape of thread would be as fatal to accurate measurement of diameter in the system described by "Jarno" as in that described by myself; because a screw thread which varies from the correct angle can be of the right diameter in one place only; if it be just the right size at the middle of the height of the thread, and the angle in the thread varies from the correct one, it will be too large or too small at the top; and if too large at the top, it will be too small at the bottom, and *vice versa*. It is evident that the "nibs" used in the system described by "Jarno" can never touch except at the top or bottom of a thread, unless that thread is of precisely the right angle. If the angle of the thread measured be less than 60° the nibs will touch at the top of the thread only, and the reading would indicate the right size, when in fact the screw would be too small, except just at the top of the threads. On the other hand, if the angle be more than 60° the nibs will touch at the bottom of the threads only, and when the right size is indicated the screw will in reality be too small, except just at the bottom of the thread. I do not mention this because I think it need be any serious objection to that system, but merely to show that if errors of angle or shape of thread enter into the question, neither system will give correct results. And it seems to me that if error arises from that cause, it would be less with the ball contact pieces than with the others, for the reason that the balls will always come in contact with the threads at some distance from either the top or bottom, and *may* come in contact midway of the height of the thread, which the nibs can never do unless the angle is just right; and if the thread varies from the correct angle it is evident that the maximum variation from correct size will be less, the nearer the point of contact of the measuring surfaces comes to the center of the height of the thread.

It would appear from this, that either system of measurement requires, as a necessary condition to the securing of accurate results, correct angle of thread; or, in other words, the tool with which the threading is done must be of precisely the right form, and set correctly in the lathe. In practice it seems to me that this point is hardly less important than the measurement of sizes. But there is this important difference in the two systems, the one is capable of determining sizes only by comparison with something else which is assumed to be right; while the other determines absolute sizes, without reference to any other screw.

As to the point raised by G. E. W., regarding the measurement of screws having odd or even numbers of threads, he has evidently misunderstood "Jarno," whose statement, when understood, is seen to be right. By a "screw having odd numbers of threads, as one thread, three threads, five threads and so on," "Jarno" means the absolute number of threads cut on the screw, not the number of threads to the inch. There is an important difference between the two. In other words, he means single-threaded screws, triple-threaded screws, quintuple-threaded screws, and so on. It is evident that, in all such screws, a thread comes opposite a space, which is not the case with those having an even number of threads, as double, quadruple, sextuple-threaded screws, and so on.

Fred J. Miller.

On one of our prominent railroads it has been decided to take out all the inside lap of the valves in some of the large passenger engines. This no doubt would give good results if the engines had simply to haul passenger trains over a level road, but since these engines have to haul heavy trains over steep grades, it seems to us that the desired speed will not be obtained.

A Fine Level.

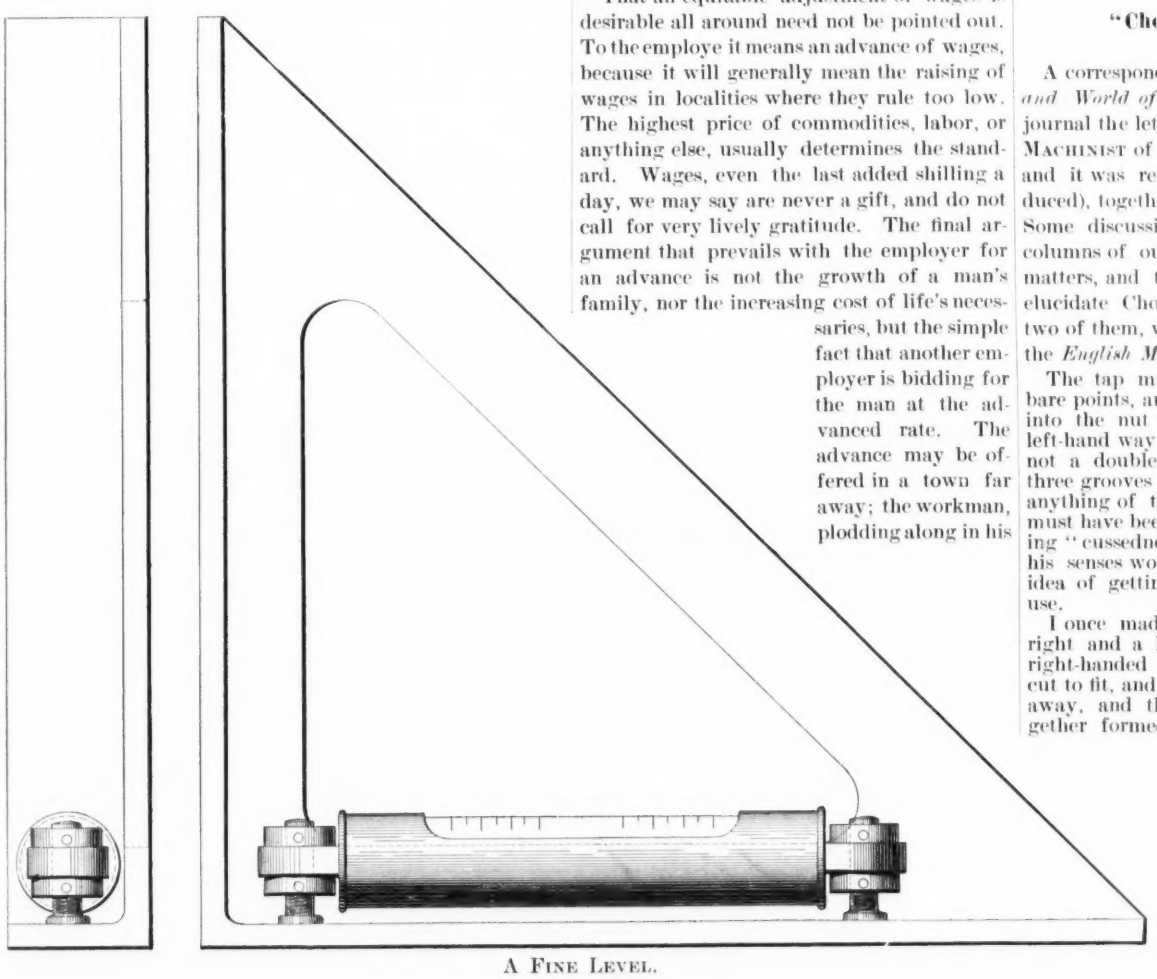
We recently mentioned some fine levels in use in the machine shop of the Bridgeport Machine Tool Works, some of which had been made from designs published in these columns.

Our present illustration shows the construction of one, which is of their own design, and is a very fine tool.

It will be seen that it can be applied to either horizontal or vertical surfaces, the two faces of the triangular frame being made precisely square for that purpose.

The construction is made plain by the engraving, it being necessary to say only that it is made entirely of brass, and very finely finished.

The level glass is of excellent quality, graduated upon its surface, the graduations having a value of .001" in about 14". Our illustration is about half size.



A FINE LEVEL.

Shall We Trade With South America?

Consul Bacon furnishes some interesting figures, suggestive of the possibilities of trade between the United States and South America. These possibilities are great, and rapidly increasing. The subject is worthy of the serious attention of American manufacturers. Consul Bacon says:

"First.—What does this trade amount to annually, in what does it consist, and what nations command it?

"It amounts annually (exports and imports) in round numbers to $700,000,000. The countries south of the United States, consisting of the empire of Brazil, four European colonies, and fifteen republics, consist of over 40,000,000 people, and have an aggregate area of over 8,500,000 square miles; a population almost equal, and an area double, that of the United States. They are with few exceptions (Chili, the Argentine Confederation, Uruguay, a part of Paraguay, and the lower southern part of Brazil) within the tropical region, the tropic of Capricorn passing through San Paulo, which renders them in climate, production, supply and demand, the reverse of the United States. Their principal products are sugar, coffee, cocoa, fibrous plants, hard-woods, cochineal, dye-stuffs, and immense herds and flocks, furnishing countless hides and quantities of wool, all of which are greatly needed by the United States, and in return for which they should receive the innumerable articles manufactured from cotton, iron, and other hard metals, agricultural and mechanical implements, shoes, hats, watches, and, as they have no factories of their own worth the name, the countless articles formed and fashioned in the United States by the skill and invention peculiar to that country, and also wheat, corn, flour, bacon, tobacco, kerosene oil, etc.

"This commercial reciprocity of trade, made so by the laws of nature, and so much needed between these tropical or quasi-tropical countries of South America, Mexico and Central America, and the United States should, it seems, flow naturally between the two countries, and be monopolized by the latter. On the contrary, strange to say, the reverse appears; commercial statistics in fact showing that only about one-fifth of the annual trade of these countries (as stated above, $700,000,000) is controlled by the United States—indeed, of that which is important, the supplied imports to these countries, amounting annually to over $350,000,000, the United States supplies but little over one-seventh."

"Journeymen" as Wage Adjusters.

BY FRANK H. RICHARDS.

Vital questions have generally two or more sides, and truth and justice seem most to prevail when all the sides are fairly and strongly presented to popular consideration. We are too apt to neglect or forget one side or the other, and to fall into errors of thought and practice in consequence. An editorial in the AMERICAN MACHINIST, September 1, brings well to the front the neglected or forgotten side of an important topic. Undoubtedly we have not enough encouraged travel and change among our young mechanics. A course of travel, as part of the system of industrial education, has entirely disappeared. I find that the term "journeyman" has lost its primary signification, even in current dictionaries. The fact of a long, a too long, connection with one establishment, has been held at more than its proper value, and frequent and numerous changes have been considered a reproach, and held to be presumptive evidence of worthlessness.

Recognizing the fact that no one knows it all, that the operation of "the survival of the fittest" in method and practice results differently in different localities, there is generally something for all to learn or to teach when they come into strange mechanical surroundings. Toward the general diffusion of knowledge and the promotion of skill a double good usually results from a change of situation. One who has momentum enough to keep him from dropping helplessly and hopelessly into one of life's ruts, who is alert enough to collect or acquire knowledge wherever he goes, will also be ready to carry and impart other knowledge, and so can help both himself and others.

Travel and change of shop conditions, as a means to the acquisition of a broader knowledge, becomes more necessary continually, because some of the old means are being cut off. The shops are becoming more exclusive. It is not so easy to walk in and out of shops as a visitor as it used to be. While some restrictive discipline seems necessary from the mere enlargement of establishments, it cuts off one condition which has helped to promote our national mechanical growth. Americans, for another reason, should be the last to discourage the movement of mechanics over the land. The manufacturing centers are smaller, more numerous and more distant than in other countries, while the facilities for travel, and the general habit of travel and change, are greater.

The additional opportunities for satisfactory occupation and advancement that come with broader associations, commend the freedom of movement as much as do the knowledge and skill to be acquired. That the round peg is to be stuck into the hole nearest to it, and stay there, even if it happens to be a square hole, is neither comfortable nor profitable. Many never seem to find their proper place in life, and few find the place where they can do their best, except after many trials.

But it is of a different, and perhaps less familiar bearing of the subject, that I set out to speak. The young and enterprising mechanic, free to move around, and to seek knowledge and opportunity where he will, and exercising that freedom, performs an important function toward the trade at large, in the matter of equalizing wages in different localities. This work is none the less valuable that it is unpremeditated. So the bee, as it flies from flower to flower, in quest of honey for itself, does a larger service for the world of nature, in transporting the fructifying pollen on its body as it goes.

That an equitable adjustment of wages is desirable all around need not be pointed out. To the employe it means an advance of wages, because it will generally mean the raising of wages in localities where they rule too low. The highest price of commodities, labor, or anything else, usually determines the standard. Wages, even the last added shilling a day, we may say are never a gift, and do not call for very lively gratitude. The final argument that prevails with the employer for an advance is not the growth of a man's family, nor the increasing cost of life's necessaries, but the simple fact that another employer is bidding for the man at the advanced rate. The advance may be offered in a town far away; the workman, plodding along in his narrow lot, may not know anything about it, or, married, and hampered by many ties, may be unable to avail himself of the offer; but the young man pushing about finds the place where labor is in most demand, and takes advantage of it, and leaves a diminished labor supply and a rising tendency in the home labor market which more or less benefits those who are tied there.

I advocate in what channels I can the home life as the true life for all the people. I would do all that I can toward the establishment and ownership of permanent homes by mechanics in general. But it happens that a man who owns a house and lot in a small town, and is employed by a large concern which domineers the place, is more or less at its mercy in the matter of wages, and the changing element in the trade undoubtedly helps, in such a case, to maintain the general standard.

The coal mining regions of Pennsylvania, I suppose, hold labor under the lowest conditions to be found in this country. The laborers there are foreigners, and sifted foreigners at that. The "filthy savage of Central Europe" takes the place of the races which only a quarter of a century ago were doing our drudgery, and have been promoted. These foreigners are held down now because they actually do not know the opportunities of our broad land, nor how to avail themselves of them. They can only be kept down by unchecked immigration. Cut off the supply of mature illiteracy and brutality, and a young and restless portion will come out from among them who will soon find out what life offers them here, and leaven the race with hope and manliness.

The equalization of wages is to the interest of the employer as well as the workman. If an employer is able to take advantage of the ignorance or the helplessness of the employe, and keep his wages abnormally low, it is expecting too much of human nature to think that generally he will not do it; and the expectation meets its proper disappointment. But this gives the employer an unjust advantage in competition with another, who pays the highest market price, and he should be brought up to the standard.

Interest and duty then combine to urge the young mechanic to push out into the world to seek his fortune. His chances are better than if he fossilizes at home, and helping himself he will be helping all; but he should not forget that the same qualities win, the world over.

"Chordal's Tap Puzzle."

A correspondent of the *English Mechanic and World of Science* (London) sent to that journal the letter published in the AMERICAN MACHINIST of Aug. 4th, entitled as above, and it was reprinted (the cut being reproduced), together with our comments upon it. Some discussion had been going on in the columns of our contemporary upon similar matters, and the participants were invited to elucidate Chordal's puzzle. The letters of two of them, which we give below, appear in the *English Mechanic* of Sept. 7th.

The tap must consist of little more than bare points, and must have been thrust hard into the nut whilst turning the reverse or left-hand way. The nut must have a triple, not a double thread—*i. e.*, if the tap has three grooves as shown. As to being a fit, or anything of the sort, don't mention it! It must have been done by someone of exceeding "cussedness" for a wager, as no man in his senses would make such a tap with the idea of getting a profit out of its legitimate use.

I once made a nut tapped with both a right and a left-handed thread, and a screw right-handed and another left-handed were cut to fit, and then half of each was planed away, and the two semi-cylinders put together formed a complete cylindrical screw, each half fitting into one of the threads of the nut. A turn of the nut moved each semi-cylinder a whole thread, and so made them slide two threads on each other, or, as both were 14 threads to an inch, they moved relatively to each other one-seventh of an inch per turn of the nut. Would this do for a "turn buckle"? Whatever that may be I cannot imagine.

J. K. P.

If "Ashford" will trace two threads around a cylinder, one having twice the pitch of the other, and being right and left-handed respectively, he will find that they cross at three points corresponding to the three cutting points of the tap in question. Hence, if these threads be cut inside a nut, the points of a tap such as described will run in either thread. I say "points" advisedly, for though the tap may accurately fit the one thread it was made to cut, there can be no accurate fit in the other one, and the feat would be impossible unless nearly all the thread was cut away in forming the tap, leaving only what I have described as "points."

A similar question has been asked in the *E. M.* about cutting a left-hand thread with right-hand dies. This, too, can be done by taking dies which only touch at points, and forcing them to cut the particular thread (right, left, single, double, etc.) you may desire.

NEPHESH.

It will be noticed that "J. K. P." says there must have been three threads in the left-hand nut; but nevertheless there were just two, and no more. He should read Mr. Frank H. Richards' explanation, in our issue of Aug. 18th. Reading this carefully will undoubtedly help him out of the trouble under which he now labors.

Of course they use in England what we call "turn buckles," but it is evident they are not generally known there by that name.

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The Inventor vs. The Trust.

Occasionally the organizers of a trust do not find their way into the pockets of the people all plain sailing. True, they usually "get there," but it is pleasant to record an instance of a failure to do so once in a while. The inventive American mechanic sometimes gets in the way of their success by devising a substitute for the thing which has been cornered. The old adage declaring necessity to be the mother of invention is as true as ever, and the operations of some of the trusts seem to be furnishing the maternal necessity, while the mind of the fertile and resourceful American performs the other necessary generative functions.

The trust organized to "regulate" the prices of jute bagging seems not unlikely to come to grief by reason of the invention of a substitute for jute bagging made of cotton waste, which it is claimed can be sold far below the cost of jute bagging, and will answer every purpose as a covering for cotton bales as well as that material.

It is estimated that, if it answers the purpose, it will reduce the cost of baling the crop by $2,500,000; an item which is well worth saving, and out of which we hope the originator of the idea may get a liberal share for his services to the community.

Cotton waste, however, is one of the machinist's best friends, and it is to be hoped that this new invention will not result in such a demand for it as to place it out of his reach.

In this connection it is pertinent to remark, however, that a substitute for cotton waste for cleaning machinery has for some time been used to some extent, and by many is thought to answer as well.

Perhaps increased cost of waste would operate as increased cost of jute bagging has done, and lead to the invention of still better substitutes, and even if it did not, we imagine most machinists and engineers would be content to be just a shade less clean, if the necessity for being so was the result of a condition brought about in an effort to circumvent a trust, the existence of which had a direct tendency to increase the price of the overalls and shirts they are trying to keep clean.

We suggest to those of our readers who are inclined to invent something, that they turn their attention to the things which are made the subjects of trust operations, and thereby, if possible, not only make themselves wealthy, but place the community under everlasting obligations to them; and may every one who tries it succeed.

Worthless Patents.

Only a small percentage of all the patents issued from the United States patent office have any value, while many of them are so palpably worthless that it seems a wonder that they should ever have been thought to have had any value. One, and probably the principal reason, for the appearance of so many ridiculously worthless patents is that so many alleged inventions are made by those having little or no knowledge of that to which their inventions relate. A man who knows literally nothing about operating a locomotive engine is much more likely to set out in an attempt to improve it than the man who is familiar with all the requirements. Or with no practical knowledge of mechanics he will devise something purely mechanical in its nature. To him the matter looks plain enough, but a mechanic would not think twice before condemning it. In due time he secures a patent for what every one who knows anything about the matter knows to be worthless. He helps swell the list that adorn the pages of the *Official Gazette* of the Patent office, and that is all that comes of it, except that it may help furnish a text from which some would-be-reformer will rail at all patents and at the operations of all patent law.

It might be supposed that a man working in a direction new to him would be kept from glaring error by the advice of those familiar with the subject. But curiously enough, this is seldom the case. Mechanics learn from experience to refrain from offering adverse advice in such matters, for the reason that it is almost certain to offend. Inventors, like other human beings, ask advice to have their schemes approved.

There is probably no way of abridging the number of useless patents issued, except by increasing the difficulty of obtaining a patent. This plan has been urged, but the remedy is worse than the disease. In fact, the idea that serious harm comes from the multitude of patents issued rests on a poor foundation. The patent office pays its own way, and if people want to contribute for the privilege of having their names recorded there in connection with some worthless device, who should object?

To Try the Interstate Commerce Law.

The great coal companies of the country have adopted their usual plan to enable them to make the customary fall advance in prices. That is, they have put, for the present at least, the individual operators at such a disadvantage that they cannot compete with them in price, and so prevent the raise, which the individual operators say is uncalled for. The great companies are enabled to do this through controlling the railroads over which the coal is transported, and discriminating against the individual operators in the way of charges for transportation. This discrimination is said, in some instances at least, to amount to as much as 75 cents per ton. But the individual operators propose to see what virtue there is in the Interstate Commerce law, by the terms of which discrimination of this kind is forbidden. In other words, they propose to fight for the right, under that law, to market coal. The great companies raise the price of coal every fall, causing not only a good deal of suffering amongst small consumers, but frequently to the serious injury of manufacturers. Hence every fair-minded person will wish the individual operators success in the fight, without much reference to their ultimate motives, or as to whether the advantage to the public will be more than temporary. It might be better to say that every fair-minded person will hope for the present discomfiture of the coal barons, notwithstanding there is no probability that it will be of long duration. If there is any virtue in the Interstate Commerce law here is a case where it ought to be made manifest without delay.

Prof. Richard A. Proctor.

It is with a feeling of profound regret that we record the death in this city, on the 12th of September, of the famous astronomer, Prof. Richard A. Proctor.

Though he had for some years resided in this country, he was a native of England, where he was born March 12th, 1837. He graduated at Cambridge in 1860, and four years later began to take an active interest in mathematical and astronomical studies. He soon became prominent among astronomers, and was a prolific writer upon astronomical subjects, his earlier works being strictly scientific.

His subsequent works, of which there is quite a long list, are mostly of a popular character, and by his writings, and also by his many lectures delivered upon the subject, in this and other countries, he has done very much to popularize the science of astronomy, and make its principles understood and its grandeur appreciated by the masses of the people.

His books and lectures have awakened many minds, and turned them in the direction of scientific thought and investigation, thus widening the mental horizon of many who had scarcely glanced at scientific work before. To accomplish this is, it seems to us, worthy of the best efforts of the most scientific of minds; and in arousing the intellect, supplying scientific knowledge, and satisfying a natural and wide-spread interest in astronomy, Prof. Proctor has accomplished a good work.

One of the most notable acts of his life, perhaps, and one which illustrates his devotion to science, was his withdrawal from the church of which he was a communicant, which he announced in a letter to one of the New York papers, in 1875—an act which was caused by his having become convinced by the authorities of that church that the views he held upon scientific matters were incompatible with loyalty to the church.

To a mind constituted as his was, it was of course impossible to renounce and deny, or even ignore, that which his studies had given him evidence was the truth, and he therefore considered that the only possible course for him, consistent with honesty and sincerity, was to withdraw from the church.

The reports of the operations of the railroads during the last fiscal year are very encouraging. It is reported that the railroads as a whole earned more money per mile on passenger traffic than in any year since 1884, and also more on freights than in any year since 1883. It is also stated that the late new mileage has been built so cheaply as to materially lessen the average cost of the whole system. Moreover, the new mileage is so lightly mortgaged as to sharply cut down the average of funded debt per mile, and the lower rate borne by recent bond issues makes a smart reduction in the average interest liability. The gratifying feature is the fact that the reports cover a period which embraces the first full year in which the Interstate Commerce law was in force.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(437) T. J. H., Pittsburgh, Pa., asks: Will you please let me know if there are any other makers of telephone besides the Bell? I wish to get a list of them. *A.*—Other telephones have been invented, but we think no others are being regularly made in this country.

(438) J. S., Camden, N. J., asks: Have there been any patents taken out on nut locks to prevent nuts working loose, especially for use in holding the ends of rails together, and if so have the arrangements patented been successful in use? *A.*—There have been probably a hundred patents granted for the purpose named. Some of the devices it is claimed are quite successful.

(439) T. C., Brooklyn, N. Y., writes: I would be pleased to know how I can make a lacquer for polished brass, that is white in color, and which will take well and not change the color of the brass. *A.*—There are several ways of making such a lacquer, but the simplest and best is probably white shellac dissolved in alcohol. It should be allowed to stand for some time before using, and should also be given an opportunity to settle, only the clear liquid at the top being used.

(440) G. H. W., Topeka, Kan., writes: We have had an argument in the shop as to the best method of applying joiners' screw-clamps. That is to say, in applying the screw-clamps to any kind of work, should the handle of the screw near the open end of the clamp be on top or on the bottom? *A.*—Theoretically, the position of the handles of the screw-clamps, when applied to work, makes no difference; the pressure on the work will be the same in all cases, so long as the power applied to the handles is the same. Practically, the position of the handles is a matter of convenience.

(441) S. M. R., Augusta, Ga., writes: My tank holds 1,000 gallons of acid. I am using a double-acting air pump whose cylinder holds one gallon. The pump makes 75 revolutions per minute; I am to raise the acid 75 feet. Please give me a rule for finding how long it will take to empty the tank. *A.*—Under the assumption that the cylinder fills every time, the pump during each revolution will take two gallons out of the tank. Since the pump makes 75 revolutions per minute, it will take out of the tank $75 \times 2 = 150$ gallons per minute. The tank holds 1,000 gallons, therefore to find the time required to empty the tank, we have

$$\frac{1000}{150} = 6.66+ \text{ minutes.}$$

The height of 75 feet to which the acid has to be raised is not taken into account, because it has nothing to do with the time required to empty the tank. But if it is required to find the power necessary for doing this work, then this height would have to be taken into consideration.

(442) W. R. S., Meridian, Miss., sends sketch of two drums; the one designated No. 1 being 12 inches diameter, and having upon its axis a spur gear wheel 30 inches diameter, driven by a pinion 6 inches diameter; the pinion being driven by a crank having a radius of 18 inches. The drum

designated No. 2 is 8 inches diameter and at one end of its axis there is a crank, having a radius of 18 inches. He asks the following questions regarding them: 1. How much more power will I have with No. 1 than with No. 2, same weight applied to each, say 100 pounds? *A.*—By the term power we assume that you mean to ask how much greater weight you can raise, regardless of its speed. When the drum No. 1 makes one revolution it will raise a weight attached to it 37.69, say 38 inches. The power applied to the crank will travel 113 inches at each revolution of the crank, and on account of the gearing will make 5 revolutions while the drum makes one, so that the power will move 565 inches while the weight moves 38. You could therefore raise $565 \div 38 \times 100 = 1{,}486$ pounds, barring friction. When the drum No. 2 makes one revolution the weight will be raised 25.13, say 25 inches, and the crank being on the same axis and of the same radius as the other one, the power will move 113 inches while the weight moves 25 inches; you can therefore raise with No. 2, $113 \div 25 \times 100 = 452$ pounds, barring friction. The effect of friction will be to modify the proportion somewhat, because it will be less in the case of No. 2 than in No. 1. 2. If I fasten a rope to No. 1, passing through two blocks, with three 8-inch sheaves in each block, how much more can I lift than with No. 2, having same number of blocks and five sheaves in each? *A.*—The size of the sheaves makes no difference, but if properly arranged there will be twice as many parts of the rope passing from one block to the other as there are sheaves in the block, and thus arranged the block with three sheaves will increase the force 6 times; the one with five sheaves will increase it 10 times. You can consequently lift with No. 1 $1{,}486 \times 6 = 8{,}916$ pounds, and with No. 2 you can lift $452 \times 10 = 4{,}520$ pounds, again as before, barring friction. 3. If I put a 36-inch pulley on, in place of the crank, and drive it with a 4-inch belt, will I have as much power as with two men working at the crank? *A.*—For a short period of time it would probably be about an even thing if both raised the weight at the same speed, but for a longer time the belt would have the advantage. These calculations are by no means the shortest which could be made, but are given this way to make plain the principle involved.

(443) A. H. S., Chicago, Ill., asks: Please give me the rule used in testing steam boilers. Is the strain of a boiler the same when tested with hydrostatic pressure, as when tested with steam pressure? *A.*—All new boilers, and all boilers that have been extensively repaired, must be subjected to a hydrostatic pressure in excess of the highest working pressure, in order to test the tightness of the seams and rivets, the soundness of the plates and the structural strength of the boilers. Such tests must be repeated periodically during the lifetime of the boiler. A test pressure equal to three times the working pressure was formerly held necessary by many authorities, but nowadays it is not considered prudent to subject marine boilers of the ordinary form to so severe a test. An excessive pressure may produce injuries which do not become apparent during the short test, but which continue to increase under the ordinary working pressure when the boiler is put into regular use. The test pressure must in no case strain any part of the boiler beyond the limit of elasticity of the metal. Section 4,418, of the "Revised Statutes of the United States" provides that all boilers used on steam vessels, and constructed of iron and steel plates, inspected under the provisions of section 4,430, shall be subjected to a hydrostatic test in the ratio of 150 pounds to the square inch to 100 pounds to the square inch of the working steam pressure allowed. United States naval boilers, when new or extensively repaired, are also subjected to a test pressure equal to one and a half times the highest working pressure above the atmospheric pressure. French laws require that tubular boilers of merchant vessels are to be tested to double the working pressure above the atmosphere at least once a year, and whenever repairs or alterations have been made on them. The boilers of French naval vessels are subjected, when new, to a test pressure equal to twice the working pressure, and annually thereafter to a test of one and a half times the actual working pressure above the atmosphere; but this pressure is to be kept on the boilers not longer than five minutes. The "Steam Manual" issued by the English Admiralty (1879) contains the following instructions regarding periodical testing by water pressure of the boilers of Her Majesty's ships and vessels in commission. In the case of ships having new boilers, or boilers repaired for a commission of four years, the boilers are to be tested by water pressure at the end of two years' service, and subsequently at half yearly intervals during the remainder of the commission. During the application of water pressure the boilers are to be carefully examined, and proper gauges are to be used to detect any change in the form of the furnaces, combustion chambers, etc. The water pressure is to be double the working pressure, provided that during the examination no indications of weakness are observed. Should, however, any indications of probable permanent deformation be observed, the test is to cease, and the working pressure is then to be limited to one-third that of the test pressure arrived at before such indications were seen. The Board of Trade (English) provides as follows: "All new boilers, and boilers that have been taken out of ships for thorough repair, must be tested by hydrostatic pressure up to at least double the working pressure that will be allowed, previous to the boilers being replaced in position, to test the workmanship, etc.; but the working pressure is to be determined by the stay-power, thickness of plates, and strength of riveting, etc." The usual method of testing boilers is to fill them with water and produce a pressure within them by means of a hand force pump. All the openings of the boiler are securely closed. The safety valve, which is loaded to the required test pressure, is kept raised till the boiler is completely filled with water. Then, after closing the safety valve, the pump is worked till the steam gauge indicates the test pressure. The pump should deliver only a small quantity of water at each stroke, and must be worked carefully, as the pressure rises, in order to avoid jarring the strained boiler and producing a sudden rise of pressure beyond the limit of test pressure. Some engineers close the safety valve before the boiler is quite full of water, and so retain a quantity of air to act as a cushion when the pressure is applied by the pump; but when this enclosed air escapes through leaky seams and rivets, no marks indicating such leaks are indicated on the plates. The foregoing has been taken from the treatise on steam boilers by W. H. Shock. Locomotive boilers are often tested by means of an injector made for the purpose. When boilers are tested by hydrostatic pressure, the water should always be hot. There is no difference in pressure between hydrostatic and steam tests.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

See Grant's Gear advt. on back page.

Link-Belting.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

See our new designed engine lathes in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See our new designed drill presses in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See our new designed shapers in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See our new designed brass working tools in Cincinnati Centennial Exposition, Lodge, Davis & Co.

2,000 feet of space in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See special adv't, page 16, Lodge, Davis & Co.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Lamb Knitting Machine Co., Chicopee Falls, Mass.

Machine work and pattern making. Anderson Machine Works, Peekskill, N. Y.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"Swift" Sight Feed Lubricator; no glass tubes: simple, reliable. Swift Lub'r Co., Elmira, N. Y.

Davis Key-Seating Machines, kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Mechanical drawing, calculations, etc., taught by correspondence. I. Donald Boyer, Dayton, Ohio.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drawings, mach. patterns and models. Inventors' ideas perfected. Valentine, 15 Ahing st, Newark, N.J.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Brown & Sharpe Mfg. Co. have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.

Patents – Whittlesey & Wright, 705 8th st., N. W., Washington, D. C. Send for pamphlet and references.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Upright drills, improved, sizes 21", 23", 25", 28", 32", 36" swing; finely made and great capacity. Currier & Snyder, Worcester, Mass.

Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers. Frasse & Co., 92 Park Row, N. Y.

If you visit the Ohio Centennial at Cincinnati, see the Waterhouse Arc Light Plant. W. N. Gray, agent, 56 Longworth st., Cincinnati, Ohio.

Machinists' supplies, brass goods, m't'rs supplies, polishing materials, all kinds wire, metals, etc., in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing gray iron castings in large quantities can make money by corresponding with Rawson Mfg Co., Hornellsville, N.Y.

A system of easy lettering by J. H. Cromwell, giving 26 forms of alphabets. The space to be lettered being divided into squares; simple and effective. Price 50 cents. Catalogue of books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 73 articles have thus far appeared up to and including the Sept. 15, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING Co., 96 Fulton st., New York

R. G. DuBois, solicitor, counselor and expert in patent cases, 916 "F" st., Washington, D. C. Corresp. solicited; highest ref's.; send for pamphlet.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G Co., 96 Fulton st., New York.

The series of articles by J. G. A. Meyer, on "Practical Drawing," now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Sept. 22, 1888 issue, 59 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING Co., 96 Fulton st., New York.

MANUFACTURES.

Lall & Tayler will build a bicycle factory at McKeesport, Pa.

The La Grange (Ga.) Plow Works have begun to build new shops.

The Miller Cotton Batting Company will build a factory at Columbia, S. C.

J. J. Wells & Sons, will build a foundry and machine shop at Trenton, Tenn.

The Lookout Rolling Mill, Chattanooga, Tenn., will be increased in capacity.

The Elmira Cotton Mills, Augusta, Ga., will add $50,000 worth of new machinery.

The El Paso (Tex.) Gas Company contemplate putting up an electric light plant.

The Keith Machine Company has been organized at Saco, Maine. Capital stock, $250,000.

The Jacksonville (Ala.) Mining and Manufacturing Company will build a charcoal furnace.

The Bessemer Rolling Mill Company, Bessemer, Ala., will put several new boilers in their mill.

The Williamson Iron Company, Birmingham, Ala., expect to enlarge their machine shops.

J. A. Vance, Salem, N. C., is erecting a two-story machine shop 35 x 65 feet; also a foundry 25 x 40 feet.

W. W. Ashburn, Eastman, Ga., expects to put up several saw mills on timber land recently purchased.

An addition to the Whittier Cotton Mills, Lowell, Mass., is being built. Part of the addition consists of a boiler and engine room.

The Union Wind Mill and M'f'g Co., Kalamazoo, Mich., whose works were recently destroyed by fire, are now ready to fill all orders.

W. R. Walter, North Waldboro, Maine, expects to build a large set of mills to use circular board saw, heading, shingle, stone and planing machinery.

G. O. Saunders, Nashua, N. H., is building a box shook factory, and has bought 700 acres of timber land at Conway, where he will put up a saw mill, and will add box machinery.

D. J. Spaulding, whose saw mill was recently burned at Withee, Wis., is building another. The capacity will be 60,000 feet of lumber, 80,000 shingles and 40,000 lath in ten hours.

A wood pulp mill, with a capacity of from twelve to fifteen tons, dry weight, is to be built at Oregon City, Ore., by the Willamette Paper and Pulp Company. Work on construction is about to begin.

There is water-works agitation at Groveton, N. H.; New London, Conn.; Tascosas, Tex.; Rockmart, Ga.; Tullahoma, Tenn.; Hays City, Kan.; Cedartown, Ga.; Acworth, Ga.; Gainesville, Fla.; Pinconning, Mich.

New water-works or the improvement of existing works are contemplated at Olean, N. Y.; North Bend, Neb.; Potwin Place, Ky.; Ellis, Kan.; Aiken, S. C.; Goffstown, N. H.; Rockmart, Ga.; Madison Wis.; Hays City, Kan.

It is said that the Baltimore & Ohio Railroad Company have put a commission of experts at work examining the shop tools in their various shops, with a view to introducing the most approved appliances for doing work.

Perkins & Co., Grand Rapids, Mich., have recently put on the market a new rotary shingle machine. This machine is designed to make shingles faster than by any other method now in use, and is being very favorably received.

The Clayton Air Compressor Works, 43 Dey street, New York, have issued a large complete catalogue, designed to supersede all previous catalogues. It is quite fully illustrated, and briefly describes the machines and machinery made at the works.

The Reliance Gauge Company, of Cleveland, O., recently received through the Reading Iron Works, of Philadelphia, another order from the Pencoyd Iron Works, of Pencoyd, Pa., a suburb of Philadelphia, for eight of their safety water columns. This is the fourth order from the Pencoyd Iron Works, they having first put in a few of these safeguards about two years ago, and having added them from time to time, until now all their boilers are equipped with them.

The Hainsworth Steel Company is the name of a new corporation in Pittsburgh, Pa. Capital $500,000. The following gentlemen, all connected with the Pittsburgh Steel Casting Company, are named as incorporators: William G. Johnston, John Irwin, jr., Charles Bailey, Thomas C. Lazear, Stewart Johnston and William Lyon.

The Memphis & Charleston Railroad Company will begin work at once on their new shops at Sheffield, Ala. The shops will cost about $300,000, and will consist of a machine shop 100 x 200 feet; blacksmith shop, 90 x 100 feet; paint shop, 40 x 100 feet; car shop, 90 x 100 feet; copper and tin shop, 90 x 100 feet, and engine and boiler room 40 x 100 feet.

The Southern Pacific Railroad Company have ordered for their depot and surroundings at Los Angeles, Cal., a combined arc and incandescent plant manufactured by the Waterhouse Electric & M'f'g Co., of Hartford, Conn. The installation consists of eight 2,000 candle-power double arc lamps, twenty-four 25 candle-power lamps and ten 100 candle-power lamps.

Gould & Eberhardt, of Newark, N. J., have recently made shipments of machine tools to Buenos Ayres, Mexico and Canada, and have also received the order for the eleventh drill from one party using the Eberhardt's drill presses, sizes ranging from 30" to 42". The works are busy on their regular line of tools. One of the new Eberhardt's rack cutter was recently shipped to Geo. W. Fifield, Lowell, Mass., who also uses the automatic gear cutter of the Gould & Eberhardt make.

A press dispatch from Youngstown, Ohio, says: "J. N. Whitman, of Syracuse, N. Y., the owner of a patent process for rolling hoop iron, is here negotiating with local capitalists in regard to erecting a mill for the manufacture of his specialty. His process, by which hoop iron can be rolled to any desirable length, and automatically rolled instead of bundled, has been tested at the Warren Rolling Mills and has proven satisfactory. It is likely that a mill will be established here."

We understand that the large car shops of the U. S. Rolling Stock Company, now building at Decatur, Ala., have, through Geo. Place, of New York, placed their entire order for bolt and nut machinery, amounting to nearly $20,000, with the National Machinery Company, of Tiffin, O. This is perhaps the largest plant this company ever furnished, the Sacramento shops of the Central Pacific Railroad coming next. This firm claims to be the only one in the United States who can furnish complete plant for bolt works. They are bringing out some new tools now, which are highly spoken of.

Mr. Rollin Defrees, representing the Atlas Engine Works at the Cincinnati Exposition, has given the following to W. N. Gray, agent for the Waterhouse Electric and M'f'g Co., of Hartford, Conn. "At your request, as manager of the Electrical Department of the Centennial Exposition of the Ohio Valley, we indicated our engine which is driving a portion of the arc lamps used for illuminating the buildings, under the following conditions and with the following results: The engine is one of our 18 x 24 automatic cut-off single valve engines, running at 170 revolutions per minute. It drives a line shaft 50 feet long, on which are 7 friction clutch pulleys for driving the dynamos. According to your statement there are altogether 7 30-light Waterhouse dynamos, operating 210 lamps, with a current of 9½ amperes, the aggregate circuit being about six miles long. The first test showed the power consumed by the engine, shafting and the dynamos, running light, to be 46.14 horse-power. The second test showed the power consumed by the engine, etc., and four dynamos, running 120 lamps, to be 128.78 horse-power, or 82.64 horse-power net for the lamps. The third test showed the power consumed by the engine, etc., and seven dynamos, running 210 lamps, to be 184.44 horse-power, or 138.80 horse-power for the lamps. This shows a net consumption of .67 horse-power per lamp of 9½ amperes." The above shows a remarkably small consumption of power in producing the Waterhouse light.

Among recent shipments of the Frick Co. engineers, Waynesboro, Pa., were the following engines etc.: One 20" x 48" Corliss engine to Navassa Guano Company, Wilmington, N. C.; three 66" x 16' return tubular boilers, feed heater, all piping, etc., to same company; one 18" x 42" Corliss engine to Swift & Co., Chicago, Ill., to run Linde refrigerating machine; one 16" x 32" Corliss engine to Buffalo, N. Y.; one 16" x 36" Corliss engine to Richard Sauer M'f'g Co., Baltimore, Md.; one 14" x 36" Corliss engine to Henry Smith & Son, Baltimore, Md.; two 14" x 36" Corliss engines to Harrisburg (Pa.) Electric Railway Co.; one 10-ton ice factory, complete, with all details to F. L. Ellis & Co., Hopkinsville, Ky.; one 10-ton ice factory, complete, with all details to W. S. Linton, Jacksonville, Ill.; one 50-ton refrigerating machine to Herman Lackman, brewer, Cincinnati, O.; one 24" x 36" slide valve Corliss bed engine, to Bawman, Foresman & Co., Williamsport, Pa. Among orders of last week are the following: one 25-ton refrigerating machine, tanks, piping, etc., for Union Stock Yards and Distilling Company, Peoria, Ill.; one 25-ton ice plant, complete, for Little Rock, Ark; one 10-ton ice plant complete, for Owensboro, Ky.; one 20" x 42" Corliss engine, condensing, Philadelphia, Pa.; one 22" x 48" Corliss engine for Wilson Cotton Mills, Tarboro, N. C.; one 18" x 36" Corliss engine for Standard Cotton Co., Rich Hill, S. C.; one 18" x 42" Corliss engine for Swift & Co., Chicago, second order; also several large automatic cut-off engines, boilers, etc. Business is good with this firm, and plenty of work in the field, and a fair percentage of orders.

Machinists' Supplies and Iron.

New York, Sept. 20, 1888.

Iron—American Pig—The demand has been moderate and chiefly for small lots for immediate use. The market rules steady, furnacemen being generally willing to accept business at former prices. Western and Southern furnaces find a market for their products in adjacent localities, and this market is therefore not affected by their competition. We quote Standard brands No. 1 X Foundry, $18.50; No. 2, $17 to $17.50, and Grey Forge, $15.50 to $16.50.

Scotch Pig—Importers, owing to the increased ocean freight rates, are asking higher prices, the effect being to check business and unsettle prices. We quote Coltness, $21 to $22; Gartsherrie, $19.75 to $20; Summerlee, $21 to $21.50; Eglinton, $19 to $19.25; Dalmellington, $20.25 to $20.50, and Clyde, $20.25 to $20.50.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue

Wanted—Men to examine S. S. planes; see p. 11.

Wanted—Two or three very skillful machinists. Apply 151 Cedar st., N. Y. City

Mech'l draftsman and designer, has had practical shop exp., wants position. Box 20, Am. Machinist.

Wanted—Travelers for New England and Middle States, to handle mechanical goods; liberal commission. Box 17, American Machinist.

A mechanical draftsman, graduate from a polytechnic school in Norway, competent machinist, wants position. Address Box 25, Am. Machinist.

Wanted—By a new manufacturing concern in a good Western city, a draftsman with or without capital to invest. T. J., American Machinist.

Wanted—A first-class pattern maker; permanent position. Address Gaysport Foundry, Hollidaysburg, Pa.

Wanted—Position by man with 10 years' experience on motive power accounts, last part as chief clerk; best references. Box 24, Am. Machinist.

Wanted—Situation by a mechanical draftsman and designer; has thorough knowledge of pattern-making; 8 years' practical experience; correspondence solicited. Address "L," Am. Machinist.

Wanted—Position as draftsman by young man 28, graduate of technical school; six years' shop experience on various classes of work, and six years' as draftsman on tools and general machinery. Address G. N., American Machinist.

Wanted—An experienced foundryman as assistant to superintendent of large foundry in the West, making heavy machinery castings in connection with a large manufacturing establishment; must have full knowledge of mixing various irons and moulding of heavy general castings. Applicant should give references and general history of applicant's experience. Address Box 21, Am. Machinist.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner is king, and has no rival. Crescent Mfg. Co., Cleveland, Ohio.

Crescent grease cup for shafting beats them all. Sample free. Crescent Mfg. Co., Cleveland, Ohio.

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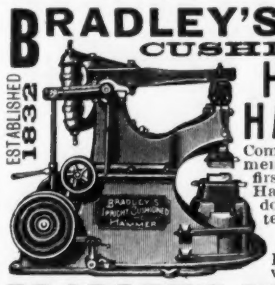

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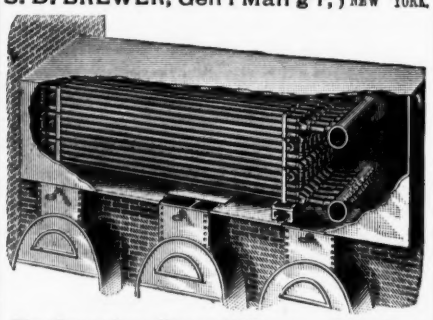

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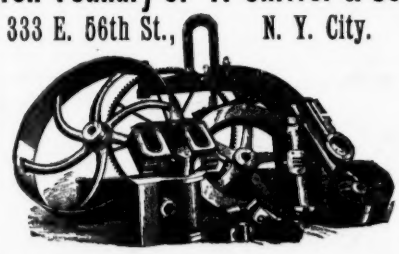

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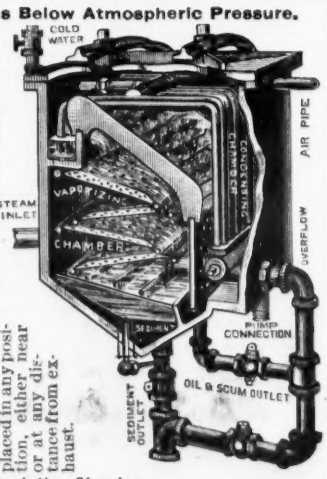

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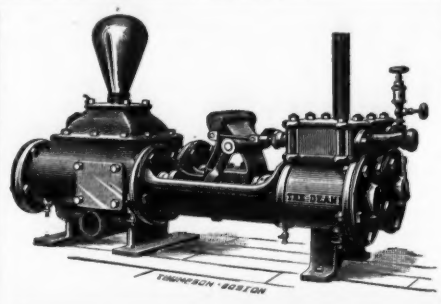

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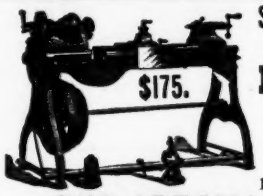

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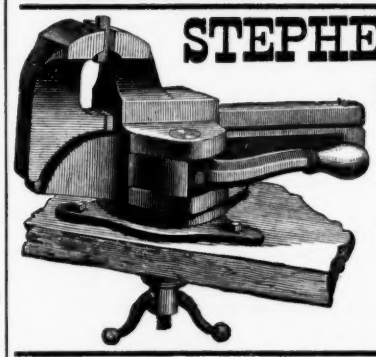

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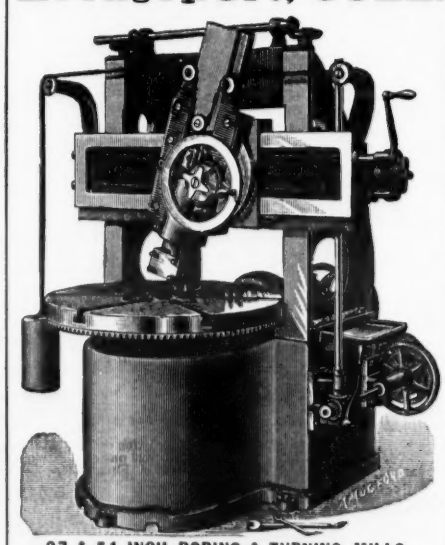

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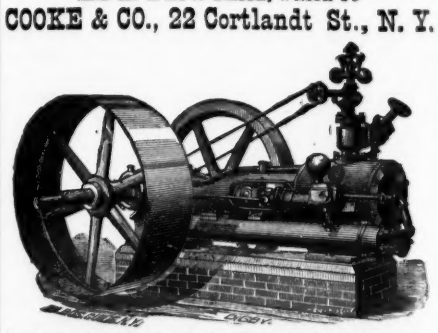

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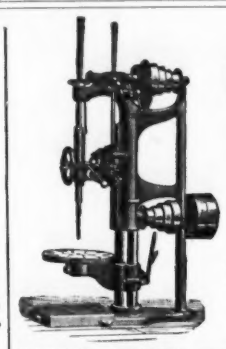

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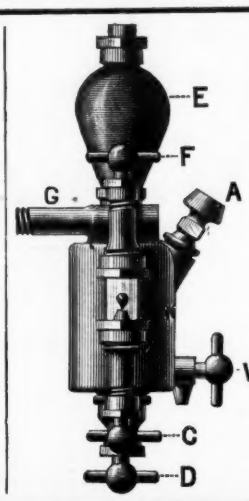

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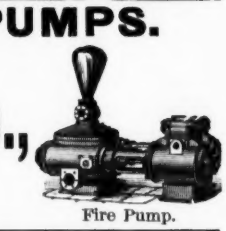

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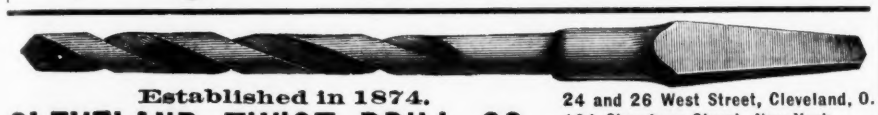

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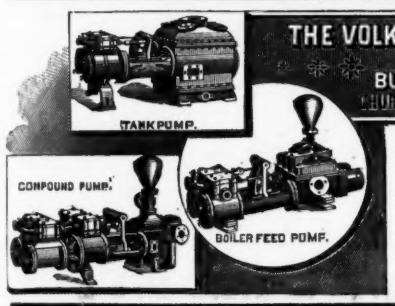

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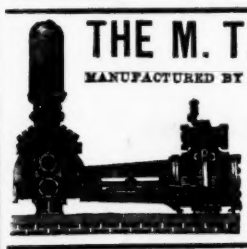

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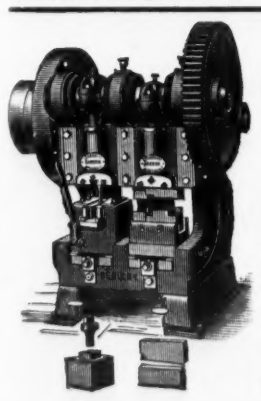

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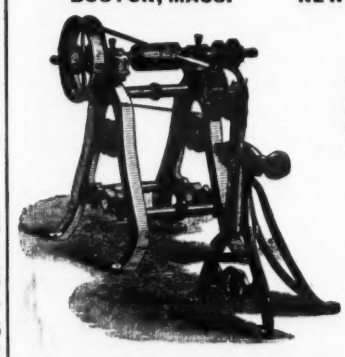

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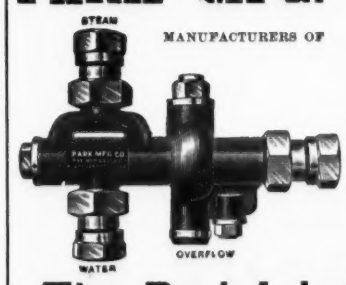

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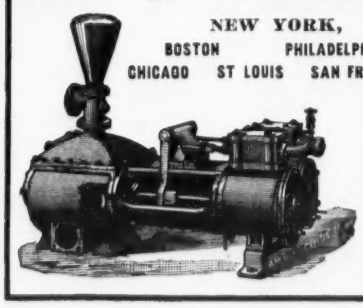

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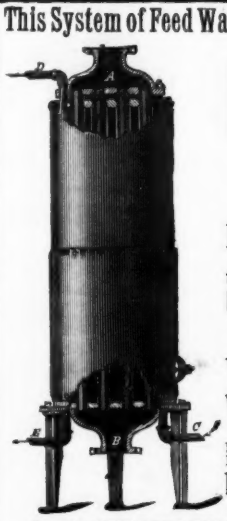

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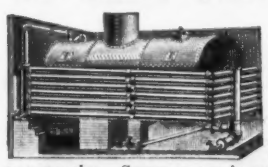

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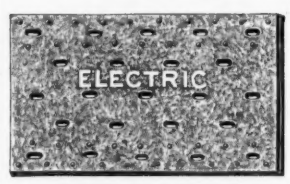

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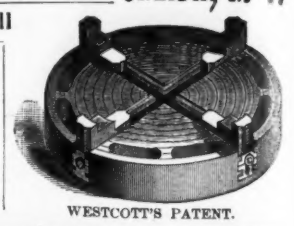

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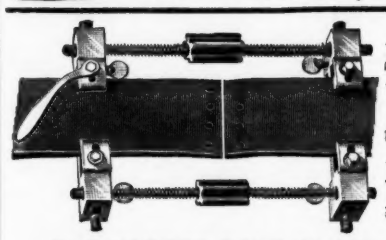

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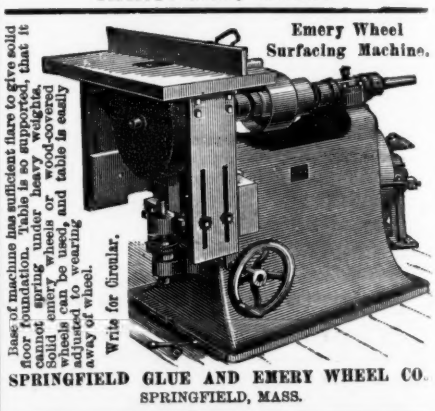

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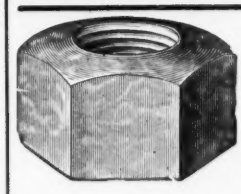

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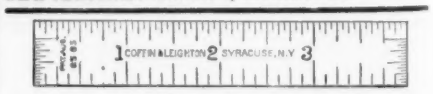

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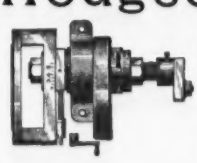

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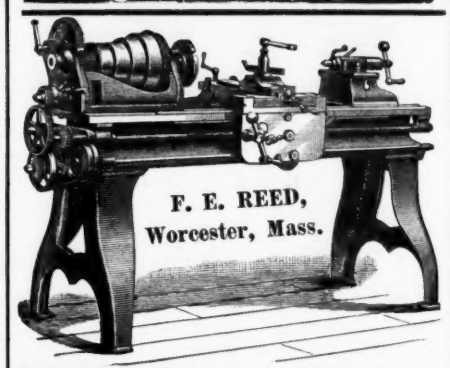

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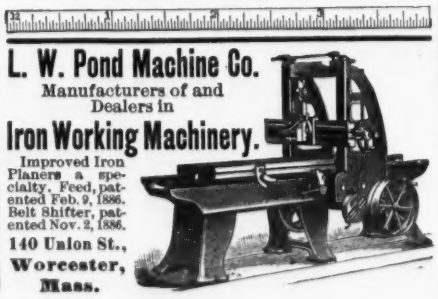

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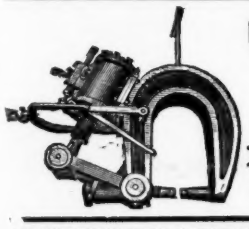

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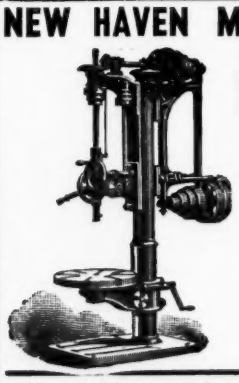

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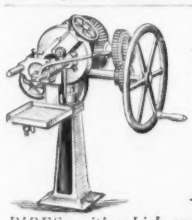

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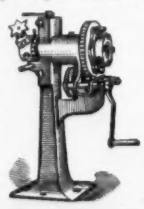

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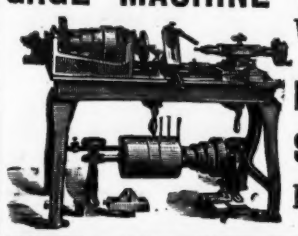

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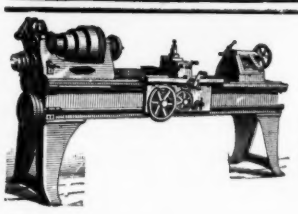

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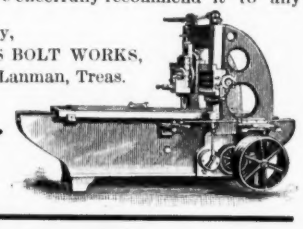

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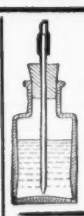

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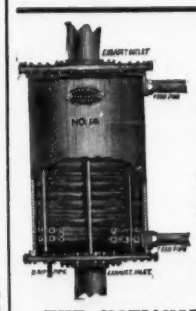

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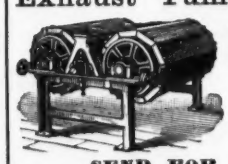

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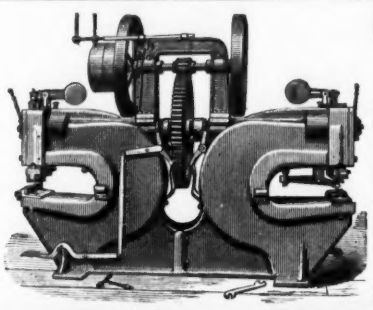

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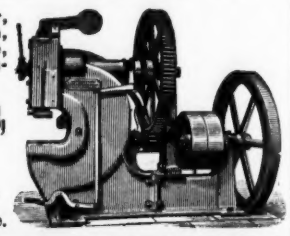

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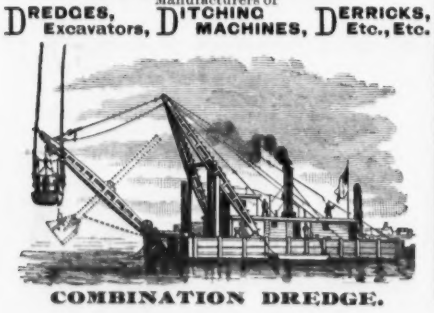

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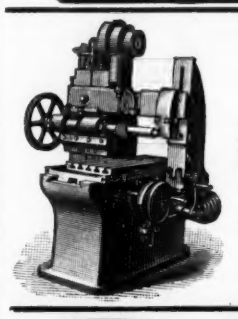

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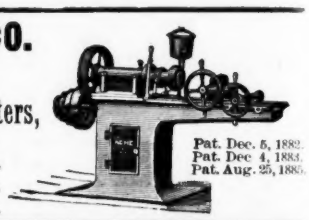

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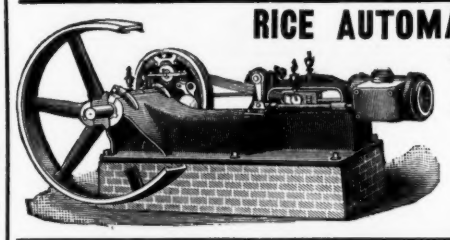

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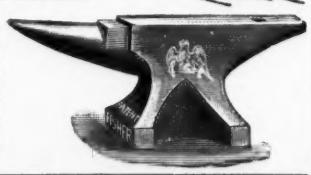

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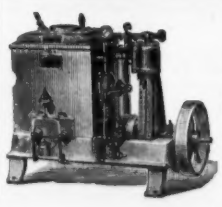

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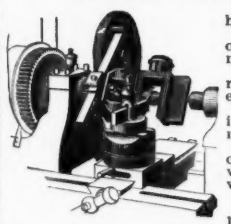

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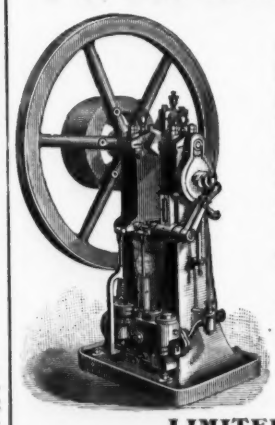

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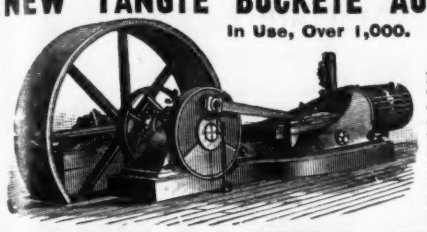

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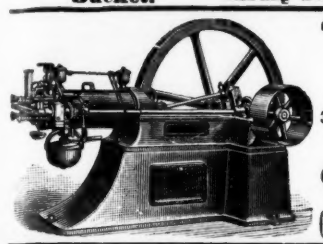

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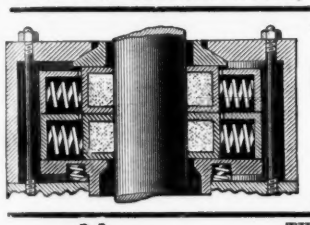

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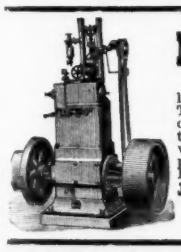

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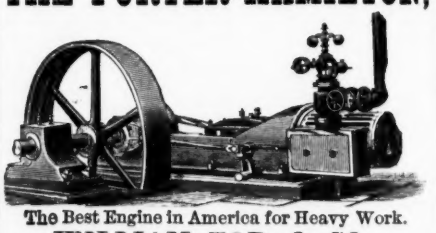

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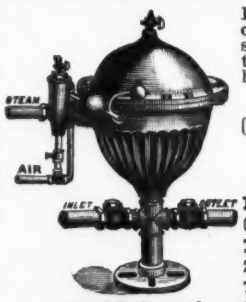

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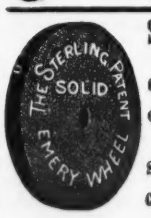

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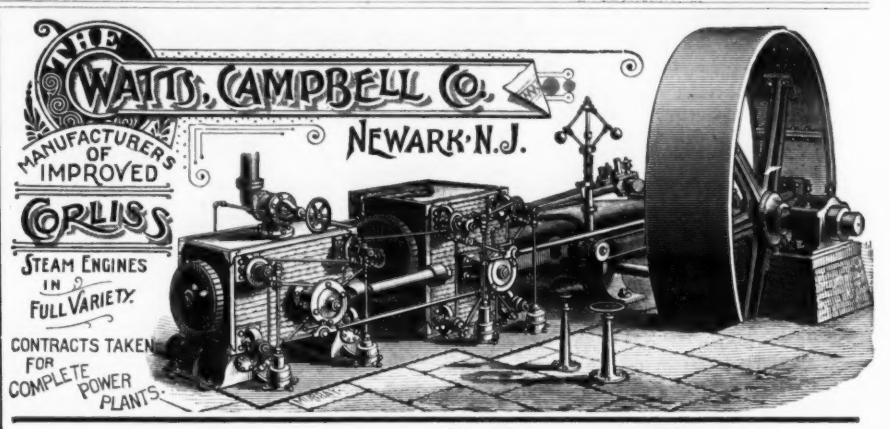

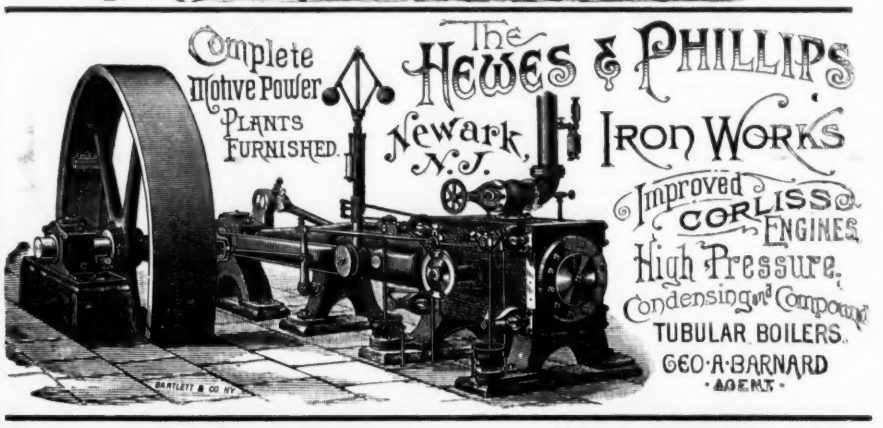

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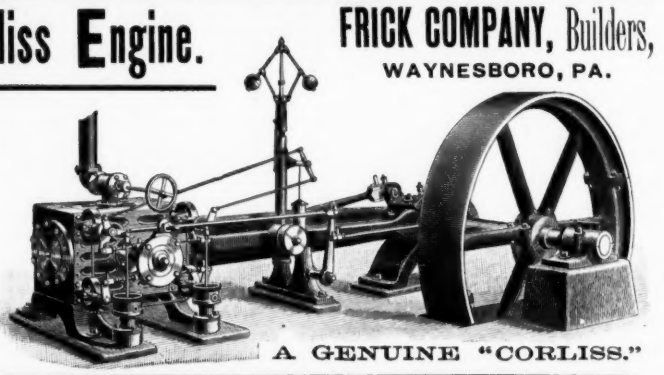

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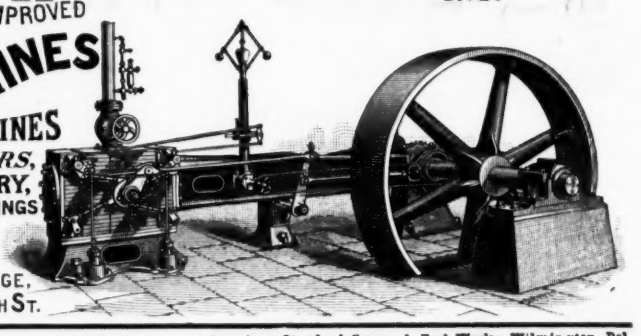

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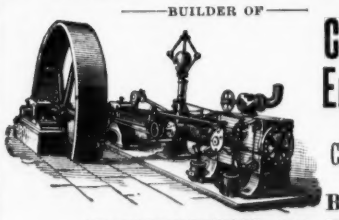

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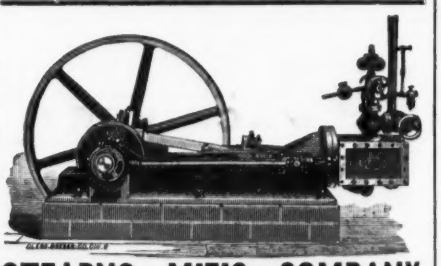

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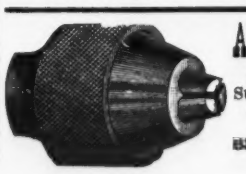

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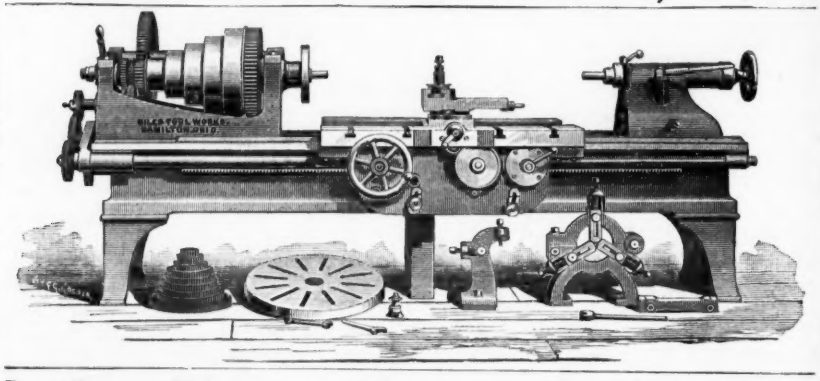

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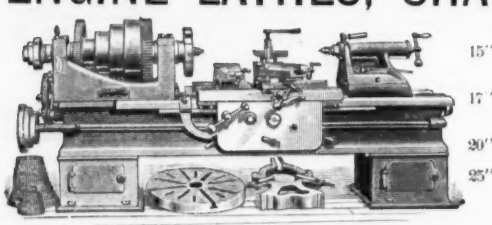

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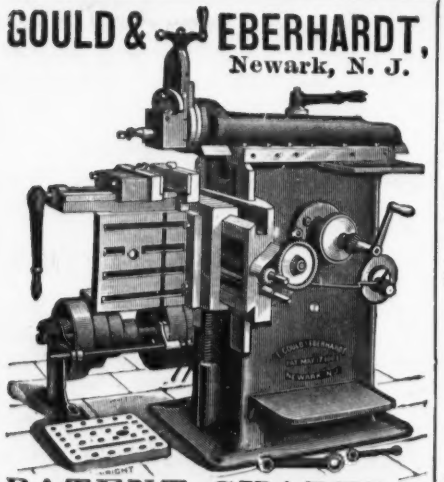

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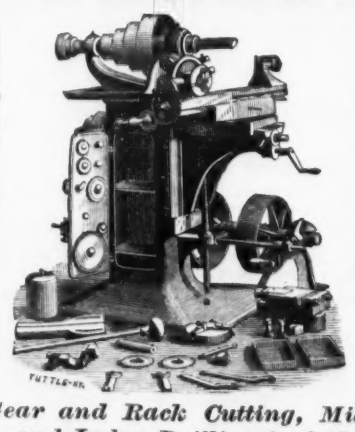

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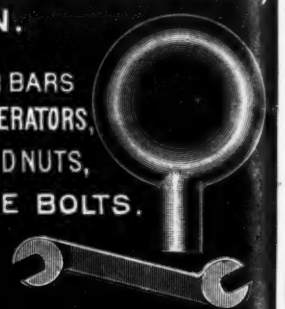

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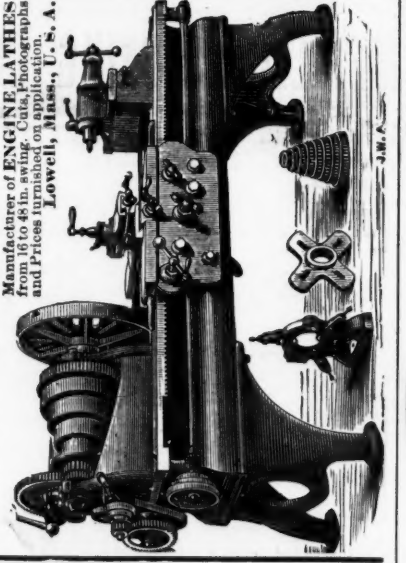

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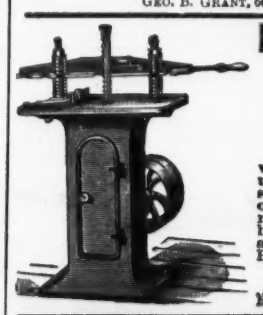

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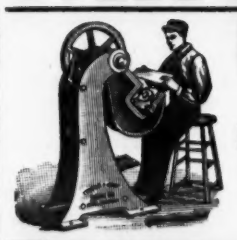

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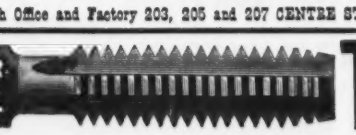

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